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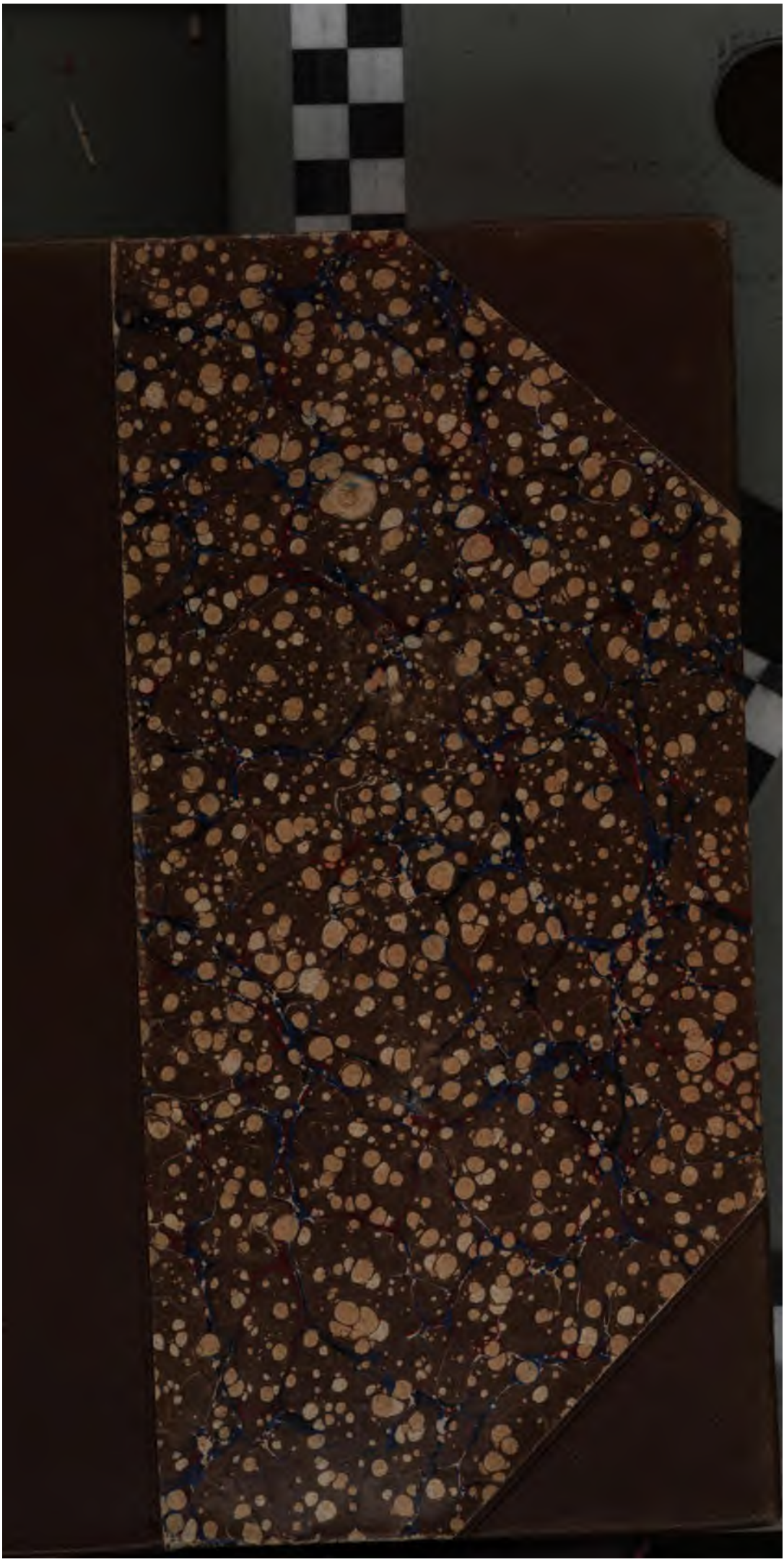
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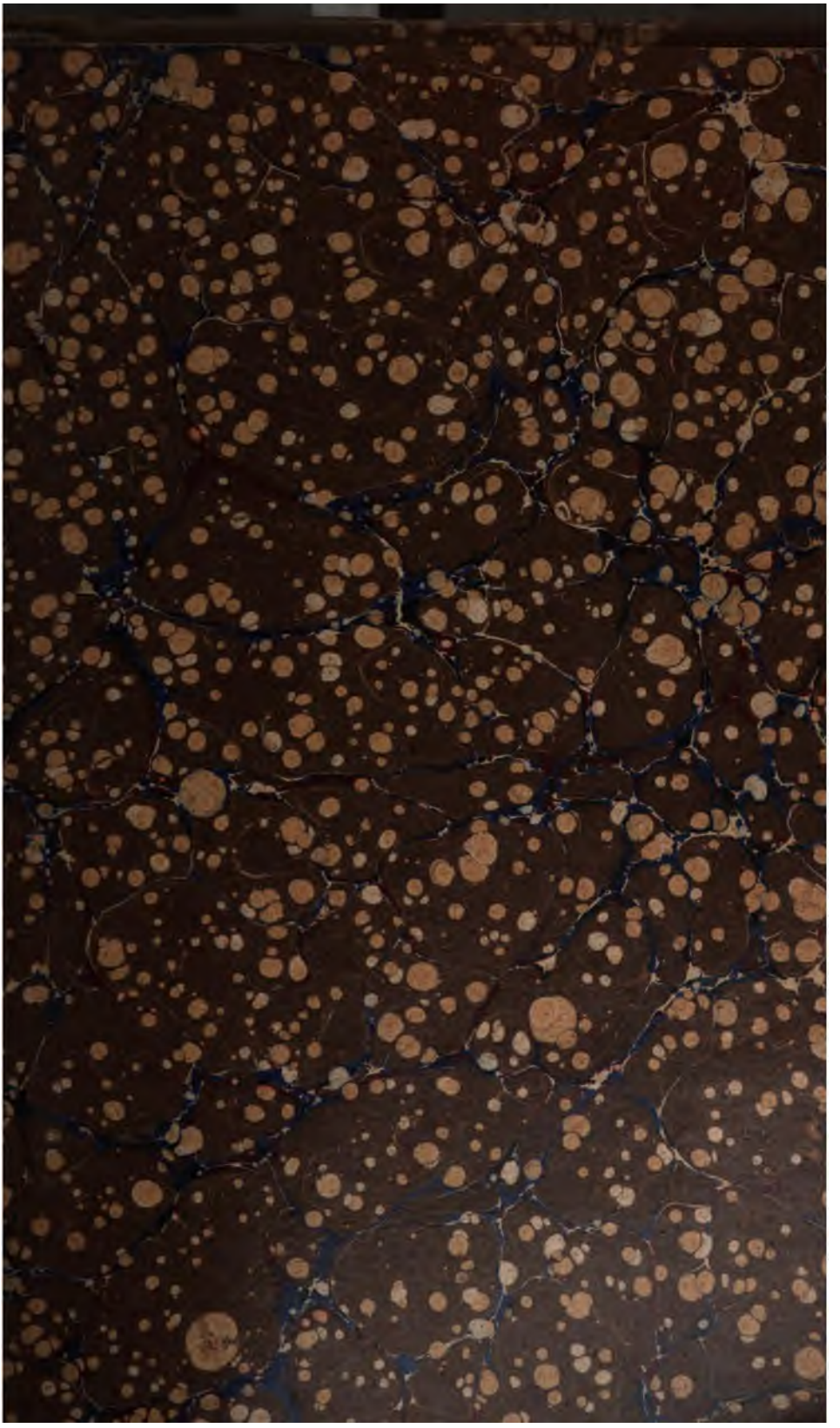
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PROCEEDINGS

OF THE

AMERICAN PHILOSOPHICAL SOCIETY,

HELD AT PHILADELPHIA, FOR PROMOTING USEFUL KNOWLEDGE.

VOL. XXX. JANUARY, 1892. NO. 137.

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☞ It is requested that the receipt of this number be acknowledged.

☞ In order to secure prompt attention it is requested that all correspondence be addressed simply "To the Secretaries of the American Philosophical Society, 104 S. Fifth St., Philadelphia."

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THE HENRY M. PHILLIPS' PRIZE ESSAY FUND.

Miss Emily Phillips, of Philadelphia, a sister of Hon. Henry M. Phillips, deceased, presented to the American Philosophical Society, held at Philadelphia for Promoting Useful Knowledge, on October 5, 1888, the sum of five thousand dollars for the establishment and endowment of a Prize Fund, in memory of her deceased brother, who was an honored member of the Society. The Society, at a stated meeting, held October 5, 1888, accepted the gift and agreed to make suitable rules and regulations to carry out the wishes of the donor, and to discharge the duties confided to it. In furtherance

PROCEEDINGS

OF THE

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FOR

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VOL. XXX. JANUARY, 1892. No. 137.

Stated Meeting, January 1, 1892.

ERRATA—VOL. XXIX, No. 136.

Page 147, 25th line from top, for N. E.½ N., read S. W.½ S.

Page 147, 25th line from top, for N. 39° E., read S. 39° W.

[illegible] des Sciences, Cracow, Austria; Naturwissenschaftliche Verein des Reg.-Bez. Frankfurt, Germany; Hydrographische Amt des Reichs-Marine-Amts, Messrs. Friedländer und Sohn, Berlin; Gartenbauverein, Darmstadt; Deutsche Gesellschaft für Anthropologie, Ethnologie, etc., Munich; Société Hollandaise des Sciences, Harlem, Holland; Biblioteca N. C., Florence, Italy; R. Accademia dei Lincei, Biblioteca N. C. V. E., Rome; Société Americaine de France, Société de Geographié, Rédaction "Cosmos," Paris, France; Philological Society, Cambridge, England; Royal Astronomical, Meteorological, Geographical Societies, Lords Commissioners of the Admiralty, "Nature," London; Manchester Geographical Society; Theological Seminary, Andover, Mass.; American Statistical Association, Dr. William Elliot Griffis, Boston, Mass.; Museum of Comparative Zoölogy, Cambridge, Mass.;

Newport Sanitary Protection Association; Hartford Theological Seminary, Travellers Insurance Co., Hartford, Conn.; Yale University, Prof. H. A. Newton, New Haven, Conn.; University of the State of New York, Albany; Cornell University, Ithaca, N. Y.; American Chemical Society, Historical Society, Meteorological Observatory, New York; College of Pharmacy, Messrs. Lea Brothers & Co., Editor of the "Medical and Surgical Reporter," Editor of "Pennsylvania County Court Reports," Prof. E. D. Cope, Philadelphia; Johns Hopkins University, Editor of the "American Journal of Philology," Baltimore, Md.; Department of State, Washington, D. C.; Agricultural Experiment Stations, Morgantown, W. Va., Experiment, Ga., Auburn, Ala., Raleigh, N. C., Lafayette, Ind., Corvallis, Oreg., Ames, Ia., Fort Collins, Colo., Berkeley, Cal.; Observatorio, Rio de Janeiro.

The following were reported as duly elected Officers and Councilors of the Society:

President.

Frederick Fraley.



Councilors.

Richard Wood, William V. McKean, Richard Vaux,
Isaac C. Martindale.

Councilor for two years, vice Aubrey H. Smith, deceased.

William P. Tatham.

The report of the Finance Committee was presented, and the appropriations for the year ending November 30, 1892, passed.

Nominations for Librarian being in order, Dr. Morris renominated Mr. Henry Phillips, Jr., and Prof. Cope nominated Mr. B. S. Lyman, and the nominations were closed.

Pending nomination for membership 1232 and new nomination 1233 were read.

Prof. Cope offered for the Transactions a paper entitled "A Synopsis of the species Tied, genus Cnemidophorus."

On motion, the paper was referred to a Committee, to be appointed by the President at his leisure.*

Prof. Cope presented for the Proceedings a paper by Prof. George Baur (of Worcester, Mass.), on the "Taxonomy of the genus Emys, C. Dumeril."

Curator Morris exhibited a variety of objects from the cabinets of the Society.

Dr. Cope suggested that when a paper is presented through a member of the Society for publication, in case of its non-acceptance, it should be returned to the member offering the same, and not sent to its author.

And the Society was adjourned by the President.

* The President subsequently appointed as such Committee, Drs. Ryder, Jayne and Sharp.

The Temperate and Alpine Floras of the Giant Volcanoes of Mexico.

(*Being a Report from the Committee on the Michaux Legacy.*)

By Prof. Angelo Heilprin.

(*Read before the American Philosophical Society, January 15, 1892.*)

Hemsley, in the fourth volume of his report on the botany of Mexico nd Central America, enumerates 130 species of flowering plants, exclusive of sedges and grasses, which reach or pass beyond the 10,000-foot line on the slopes of the four principal volcanoes of the Mexican Republic—Orizaba, Popocatepetl, Ixtaccihuatl and the Nevado de Toluca.* This enumeration is based mainly upon the data found on the labels of the various collections illustrating the region, and omits passing citations; it is thus, necessarily, to an extent incomplete, but yet it is an admirable survey of the general features of this upper flora. To Hemsley's list the following species enumerated by Liebmann as occurring on Orizaba can, I think, be safely added,† although possibly a few of the species require redetermination before their position or synonymy can be satisfactorily established.

	FEET.
Ranunculus Hookeri	10,000
Ranunculus llaveanus	10,000
Cerastium sp.?	14,000
Arenaria decussata	10,000
Arenaria leptophylla?	12,000
Oxalis latifolia	10,000
Trifolium amabile	10,000
Lupinus leptophyllus	10,000

	FEET.
Sesseli sp.?	12,000
Œnanthe sp.?	12,000
Viburnum sp.?	10,000
Cornus sp.?	10,000
Stevia arbutifolia	12,000
Erigeron scaposus (Aster rivularis)	10,000
Bidens sp.?	10,000
Dahlia variabilis	10,000
Chrysanthemum (?) sagetum	10,000
Cnicus Jorullensis	10,000
Hieracium abscissum	10,000
Tagetes clandestina	10,000
Baccharis Jalapensis	10,000
Diodia sp.?	10,000
Gaultheria procumbens	10,000
Pernettya (Gaultheria) ciliata	14,000
Phacelia sp.?	14,000
Solanum stoloniferum	10,000
Lamourouxia Jalapensis	9,500
Pinguicula sp.?	10,000
Castilleja integrifolia	10,000
Castilleja scorzonerifolia	10,000
Castilleja sp.?	14,000
Verbena pulchella	10,000
Prunella vulgaris	10,000
Plantago Mexicana	10,000
Juniperus Mexicana	14,000
Govenia speciosa	9,500
Spiranthes sp.?	10,000
Serapias sp.?	10,000
Tigridia pavonia	10,000
Tillandsia sp.?	10,000
Bomarea hirtella	10,000
Agave sp.?	10,000

The approximate elevations as recorded by Liebmann are, with little doubt, given in French feet. This placing does not materially alter the positions of the plants in question. To Liebmann's list I would add the following, obtained by myself and my associates during a recent exploration of the Mexican volcanoes (1890):

	FEET.
Echeveria gibbiflora? (or E. secunda?) on Ixtaccihuatl	14,200
Œnothera tetraptera on Ixtaccihuatl and Popocatepetl	11,000–11,500
Symphoricarpus microphyllus on Popocatepetl	10,500
Lonicera filosa on Popocatepetl	10,500

	FEET.
Erigeron maximus on Popocatepetl	11,200
Baccharis concava on Popocatepetl	11,000
Gnaphalium oxyphyllum on Orizaba	13,500
Senecio salignus on Ixtaccihuatl	13,200
Arbutus spinulosus on Popocatepetl	10,500
Alnus castanæfolia on Popocatepetl	10,500
Draba aretoides (?) on Ixtaccihuatl	13,200

A number of other plants, such as Habenaria prasina, Platanthera nubigena, P. longifolia, Malaxis gracilis (among orchids), have been cited by Martens and Galeotti from the peak of Orizaba, so that the total list is brought close up to 200 species. I have in the table that follows appended the approximate elevations at which the plants occur, relying largely upon the data furnished by Hemsley. The letters that precede the names of the species have reference to the special mountain peak upon which the plants were found: O., Orizaba; P., Popocatepetl; I., Ixtaccihuatl, and T., Nevado de Toluca. The author wishes in this connection to express his indebtedness for various forms of assistance to Messrs. Thomas Meehan, John H. Redfield, Isaac Burk and Witmer Stone, members of the Academy of Natural Sciences.

	To 10,000 FEET.	10–12,000 FEET.	12–13,000 FEET.	13–15,000 FEET.
O. Ranunculus geoides		9–12,000		
O. R. Peruvianus			12,500	
O. R. Hookeri	10,000			
O. R. llaveanus	10,000			
O. R. sp.?				14,000
O. Nasturtium impatiens		11–12,000		
O. " Orizabæ		12,000		
O. Draba myosotidioides			12–13,000	
P. " Popocatepetlensis		12,000		
T. " Tolucensis				8–14,000
I. " aretoides? (also O.)				13,200
O. Sisymbrium canescens		12,000		
O. " Galeottianum		8–11,000		
T. Erysimum macradenium			12–13,000	
O. Viola ciliata	10,000			
O. " sp.?				14,000
T. Cerastium andinum			13,000	
O. " orithales		12,000		
O. " vulcanicum		10–12,000		
O. " sp.?				14,000
O. Arenaria alsinoides		10–12,000		
O. " decussata	10,000			
O. " bryoides			12,500	

	To 10,000 FEET.	10–12,000 FEET.	12–13,000 FEET.	13–15,000 FEET.
T. Arenaria bryoides				14–15,000
P. " "		11,500		
O. " leptophylla? ..		12,000		
O. Colobanthus Quitensis....		12,500		
O. Oxalis latifolia	10,000			
T. Geranium potentillæfolium	9–10,000			
O. Trifolium amabile.....	10,000			
T. Lupinus bimaculatus		12,000		
O. " elegans	9–10,000			
O. " glabellus.....	9–10,000			
P. " Mexicanus.....		10–11,000		
T. " montanus	9–10,000			
O. " vaginatus		12,000		
P. " "		12,000		
T. " "		12,000		
I. " "		12,000		
O. " leptophyllus.....	10,000			
O. Fragaria Mexicana.....	10,000			
O. Spiræa discolor.....		10–12,000		
O. Rubus trilobus.....	10,000			
O. Potentilla ranunculoides..		12,000		
O. " Richardii			12,500	
O. " sp.?.....				14,000
O. Alchemilla orbiculata.....		12,000		
O. " Sibbaldiæfolia.		9–12,000		
O. " venusta	10,000			
O. " tripartita	10,000			
O. " vulcanica.....	10,000			
O. " hirsuta	10,000			
O. Acæna elongata.....				14,000
O. Heuchera Orizabensis....			11–12,500	
P. Ribes Jorullensis		10–12,000		
T. " "		10–12,000		
O. " "				13,500
O. Echeveria mucronata.....	10,000			
I. " gibbiflora? (E. secunda?)				14,200
O. Sedum sp.?.....	10,000			
P. Œnothera tetraptera		11–12,000		
I. " "		11–12,000		
O. Epilobium repens.....	10,000			
O. Mentha sp.?.....	10,000			
P. Fuchsia microphylla.....	10,000			
O. " mixta	10,000			

	To 10,000 FEET.	10–12,000 FEET.	12–13,000 FEET.	13–15,000 FEET.
O. Gaura sp.?	10,000			
O. Lopezia hirsuta.....	10,000			
O. Microsechium ruderale...	9–10,000			
O. Pimpinella sp.?.....	10,000			
O. Dancus montana.....	10,000			
O. Hydrocotyle Mexicana...	10,000			
O. Eryngium eymosum	8–10,000			
O. " protæflorum...		12,000		
T. Tauschia Coulteri.....		10,500		
O. Sesseli sp.?.....		12,000		
O. Œnanthe sp.?.....		12,000		
O. Ottoa œnanthoides.....		12,000		
O. Peucedanum Tolucense ..			12,500	
O. Viburnum sp.?	10,000			
O. Cornus sp.?.....	10,000			
O. Abelia floribunda	10,000			
P. Symphoricarpus microphyllus.....		10,500		
P. Lonicera filosa.		10,500		
O. Galium gemmiflorum	10,000			
O. Didymæa Mexicana.....	10,000			
O. Ageratum adscendens....		10–11,500		
O. " arbutifolium ..				13,500
P. " " ..		11,000		
I. " " ..				13,200
O. Stevia monardiæfolia		8–12,000		



	To 10,000 FEET.	10–12,000 FEET.	12–13,000 FEET.	13–15,000 FEET.
O. Senecia Galeottii.....		12,000		
O. " gerberæfolius				10–15,000
O. " helodes.....		11,500		
O. " multidentatus			9–12,500	
O. " Orizabensis			10–12,500	
O. " procumbens.....				12–15,000
T. " "		10–11,000		
I. " salignus				13,200
O. Bidens sp.?.....	10,000			
O. Dahlia variabilis.....		10–11,000		
O. Chrysanthemum (?) sagetum.....	10,000			
T. Cnicus nivalis.....		11,400		
O. " "				14,000
O. " Jorullensis.....	10,000			
P. Hieracium Mexicanum ...	10,000			
O. " abscissum	10,000			
O. " niveopappum .			13,000	
O. " thyrsoideum ..		12,000		
O. Tagetes clandestina.....	10,000			
O. Lobelia nana			11–12,500	
O. " Orizabæ	9–10,000			
O. Diodia sp.?.....		11,000		
O. Gaultheria procumbens...	10,000			
O. Arctostaphylos pungens..			12–12,500	
P. Arbutus spinulosus		10,500		
O. Pernettyia pilosa		9–12,000		
O. " ciliata.....				14,000
O. Pyrola Sartorii	9–10,000			
O. " secunda.....	8–10,000			
O. Chimaphila umbellata....	6–10,000			
O. Buddleia lanceolata	10,000			
O. Halenia alata.....	9–10,000			
O. " nudicaulis		9–12,000		
O. " nutans.....	9–10,000			
O. " paucifolia		9–12,000		
O. Polemonium grandiflora..		9–12,000		
O. Cobæa minor.....	10,000			
P. Phacelia pimpinelloides ..	10,000			
O. " " ..			12,500	
I. " " ..				13,200
O. Echinospermum Mexicanum.....	10,000			
O. Lithospermum distichum.		11–12,000		

	To 10,000 FEET.	10–12,000 FEET.	12–13,000 FEET.	13–15,000 FEET.
O. Solanum verrucosum		10–12,000		
O. " stoloniferum ?...	10,000			
O. Saracha umbellata	10,000			
O. Lamourouxia Jalapensis..	9,500			
O. Pinguicula sp.?	10,000			
O. Calceolaria Mexicana	10,000			
O. Pentstemon gentianoides .		9–12,000		
O. Mimulus glabratus			12–12,500	
O. " Orizabæ		10–12,000		
O. Veronica serpyllifolia				14,000
O. Castilleja lithospermoides.		12,000		
O. " pectinata		10–12,000		
O. " Tolucensis.....				13,200
T. " "				14,200
O. " integrifolia	10,000			
O. " scorzonerifolia ..	10,000			
O. Pedicularis Orizabæ.....		12,000		
O. Verbena teucrifolia		10,500		
O. " pulchella.....	10,000			
O. Salvia biserrata		9–10,500		
O. Scutellaria cœrulea	9–10,000			
O. Stachys repens		9–11,000		
O. Prunella vulgaris	10,000			
O. Plantago Mexicana	10,000			
O. Peperomia Lindeniana....	10,000			
O. Persea Orizabæ		7–10,500		



	To 10,000 FEET.	10–12,000 FEET.	12–13,000 FEET.	13–15,000 FEET.
O. Salix latifolia.....		12,000		
P. " paradoxa?.....		10,500		
O. Juniperus tetragona.....				12–14,000
O. " Mexicana.....				14,000
P. " "		11,500		
P. Pinus ayacahuite		11–12,000		
O. " "				13,500
P. " Hartwegii.....				13–14,000
O. " Montezumæ (also P. & I.).....				10–14,000
O. " patula		10–12,000		
O. Abies religiosa (also P. & I.).....		12,000		
O. Govenia speciosa.....	9,500			
O. Habenaria vulcanica.....		10–12,000		
O. " prasina.....			12,800	
O. Platanthera nubigena			12,500	
O. " longifolia....			12,500	
O. Malaxis gracilis...			12,500	
O. Spiranthes ochracea			12,500	
O. Serapias sp.?	10,000			
O. Tigridia pavonia.....	10,000			
O. Tillandsia sp.?.....	10,000			
O. Sisyrinchium scabrum....	10,000			
O. Bomarea acutifolia	7–10,000			
O. " hirtella.....	10,000			
O. Agave sp.?.....	10,000			
O. Echeandra terniflora		11,000		
O. Allium glandulosum		9–12,000		
O. Stenanthium frigidum....			9–12,500	

From the preceding it will appear that, exclusive of grasses and sedges, there are approximately :

		FEET.
5	species which pass beyond.....	14,000
28	" " " "	13,000
46	" " " "	12,000
97	" " " "	11,000
115	" " " "	10,000
199	" " about reach or pass beyond.....	10,000

By far the greater number of the species enumerated in the preceding list are cited from the Citlaltepetl (the "Star Mountain"), or Peak of Orizaba, as it is commonly known, which, from the specially favorable conditions surrounding its position, has attracted the attention of botanists more than any other mountain of Mexico. With its base buried in the

luxuriant forests of the eastern *tierra caliente*, it presents an unbroken botanical front to the line of perpetual snow, 15,000 feet above the sea, and thus exhibits in beautiful sequence the different vegetal zones which climate more particularly has marked out. There is probably no other mountain in the world which so thoroughly presents the essentials of a study of mountain floras as Orizaba; the luxuriance of growth at its base, the high level to which the forest zone attains, and the isolation, due to volcanic structure, of the peak itself, are the specially distinguishing features of this summit. So far as the temperate and alpine floras of the other giant mountains of Mexico are concerned—Popocatepetl, Ixtaccihuatl and the Nevado de Toluca—there is no question that they are very closely related to the similar floras of the Star Mountain, as indeed it would naturally be expected they would be. Of this correspondence I have satisfied myself through a personal examination of the floras *in situ*; unfortunately, the conditions attending the ascent of these mountains were such as to prevent us from making more than "sample" collections, but they illustrate in a broad way the general features of the vegetation. All four summits rise from the table land through a zone of pine forest. On the western slope of Orizaba, or towards the town of San Andres Chalchicomula, we found the pines, with *Pinus Montezumæ* (var. *macrophylla*—the common long-leaved species), *P. Teocote* and *P. pseudostrobus*, to begin as a distinct zone, at an elevation of some 9000 feet, occupying nearly the same position on the western slopes of Popocatepetl and Toluca; on Ixtaccihuatl the line descends approximately 500 feet lower. There can be little question, it appears to me, that the limitation downward in these special cases is not so much dependent upon climatic conditions as it is upon certain physical peculiarities of the surroundings and the artificial means that have been resorted to for the removal of the



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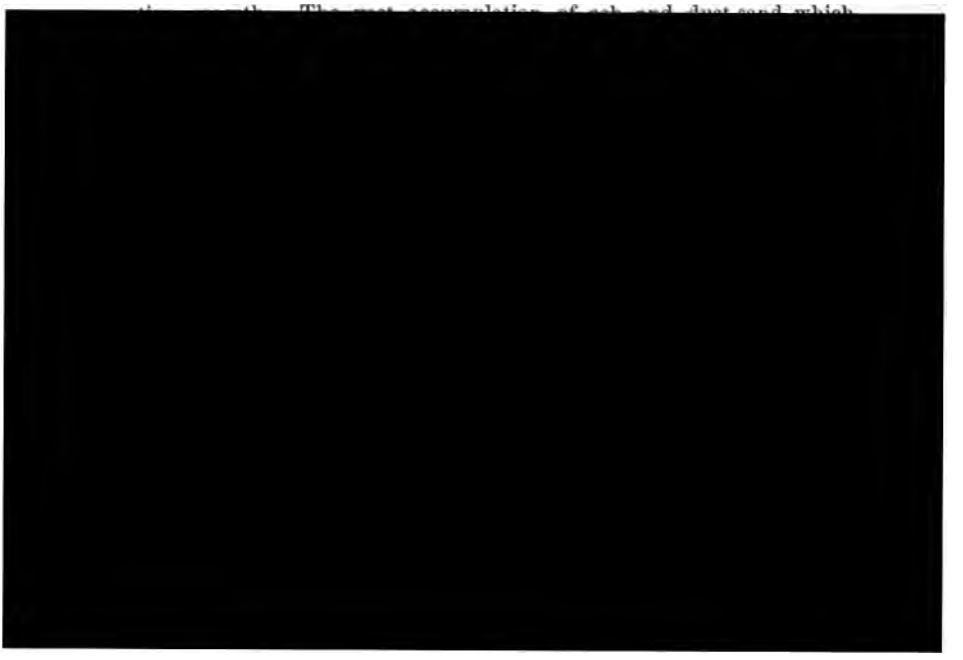
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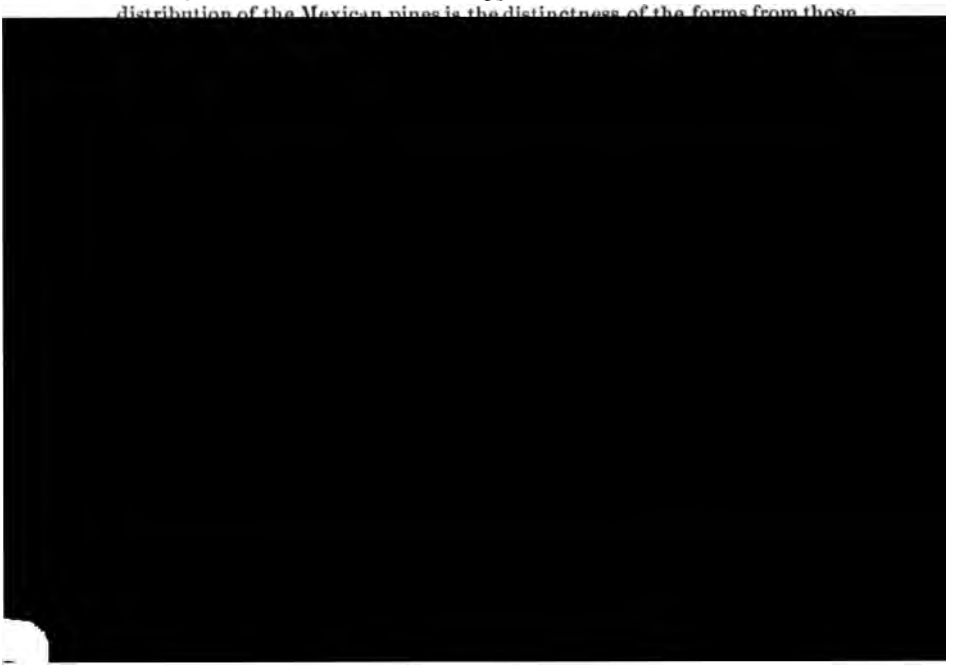
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still formed groves or thickets, they rose to a height of certainly not less than 30–40 feet. Roezl, as quoted by De Candolle (Parlatore, in the "Prodromus," xvi, ii, p. 400), and Hemsley give, it appears to me, too great an elevation for the pines on Popocatepetl and Ixtaccihuatl, 13–14,000 feet; the first figure more nearly represents the true limitation. Felix and Lenk * delimit the zone on Popocatepetl at about 250 feet above the ranch of Tlamacas, or, according to their statement, at almost exactly 13,000 feet; my own observations place the line somewhat higher, 13,160 feet †—or about 100 feet lower than the point where we met with the last pines on Ixtaccihuatl.

At no other point on the earth's surface do the pines attain such an extreme elevation as on the Mexican volcanoes; indeed, if we except the *Juniperus fœtidissima* found by Thomson in the Spiti Valley, Himalayas, at an altitude of 15,000 feet, the entire group of the Coniferæ almost everywhere falls far below this line. Barring exceptional cases, the uppermost trees on the Himalaya, as in north temperate regions generally, are conifers, but these virtually cease at an elevation of some 12,000 feet,‡ although flowering plants continue for still 7000 feet higher. On Mt. Ararat, according to Drude, the uppermost trees are birches, poplars and willows, and not conifers, § the tree line on the northwestern face of that mountain being situated somewhat below 8400 feet. On the extinct volcanic summit of the San Francisco mountain (Northcentral Arizona, lat. 35° 20′), with an elevation of 12,794 feet, Hart Merriam found the timber line at approximately 11,500 feet, marked by the disappearance of the fox-tail pine (*Pinus aristata*) and Engelmann's spruce (*Picea Engelmanni*). A somewhat higher level is, perhaps, reached by the balsam (*Abies subalpina*) in Colorado—12,000 feet. ‖

The point of most interest that suggests itself in connection with the distribution of the Mexican pines is the distinctness of the forms from those



direction of these mountains and the fact that they are continued by a plateau system of elevations of from 6000–8000 feet into the very heart of the volcanic area, this circumstance appears a little remarkable; its explanation is possibly to be sought in the same series of conditions which have determined the endemic character of the alpine flora generally of the Mexican and South American summits. In the case of such hardy perennials as the pines, however, it is more difficult to account for the anomaly than in that of the seemingly much more pliable herbaceous plants, which are commonly assumed to lend themselves more readily to changes or modifications as the result of alterations in the physical conditions of their surroundings. The comparatively recent origin of the Mexican volcanoes proves that the floras which they carry must be of equally recent date; it follows, therefore, as a corollary that if the components of these floras are derivatives from preëxisting floras still extant, such modifications of structure as they have undergone must have been rapid in their formation—more rapid, probably, than is generally allowed for modifications of this kind. Can it, perhaps, be assumed that the special characteristics and conditions which belong to elevated volcanic cones are conducive to rapid change? It is true that not all the volcanic summits of Mexico are of equivalent age, and it can probably be assumed that some are of even considerably greater age than others (although possibly belonging to the same period of geological time); thus the worn-off and effaced summit of the Ixtaccihuatl, without doubt, long antedates such perfect cones as Orizaba and Popocatepetl; and the serrated ridges of the Ajusco, or their continuations, bear a similar relation to the series of more or less perfect cones and bosses which are distributed over the plateau north of the line occupied by them. Possibly the existing flora was first developed on such ancient slopes, whence by a gradual transference it gained the position which it now holds (largely modified and altered in form).

It must be admitted, however, that our knowledge on these points is still so limited that it can scarcely originate more than speculation or surmise; it no more explains the present problem than it answers the question: Why are the pines limited to the northern hemisphere—or more definitely, why the North American pines cease so abruptly in Nicaragua? What are the special conditions which prevent them from spreading further southward, and why is the upper zone of the Andes destitute of these trees? Indeed, the endemic character of the Mexican conifers and the absence of their immediate representative in South America might suggest to some an origination wholly independent of a true North American stock—an origination suggestive of a former Atlantis. The presence of pines in some of the West Indian islands—Cuba, Jamaica, Santo Domingo, and again in the Canary Islands*—might, moreover, be taken in evidence of a trans-Atlantic land connection having actually

* *Pinus Canariensis*, the last of the three-leaved pines from the western region of the Old World.

existed at a comparatively modern period. Botanists have, indeed, long since pointed out the relation existing between the modern coniferous flora of North America and the equivalent Miocene flora of Europe—a relationship which might almost be considered an equivalency—and have even hinted at the possible derivation of the one from the other.*

The singular distribution of the pines makes it certain that neither their vertical nor their horizontal (or longitudinal) range is determined by conditions of temperature alone, or, perhaps, even primarily. Humboldt has plainly stated this fact: "This absence from the southern hemisphere of the true Abietineæ, of the Juniperineæ, Cupressineæ and all the Taxodineæ, as likewise of the Torreya, of the *Salisburia adiantifolia*, and of the Cephalotaxus among the Taxineæ, vividly reminds us of the enigmatical and still obscure conditions which determined the original distribution of vegetable forms. This distribution can by no means be satisfactorily explained, either by the similarity or diversity of the soil, by thermal relations, or by meteorological conditions." † Mr. Thomas Meehan has repeatedly insisted that the timber line on mountains is not essentially a fixture determined by climate, but depending more particularly upon special topographic features of the surroundings—the character of the soil, amount of downwash, exposure to storms, etc. The critical comparison of different timber lines, taken in conjunction with vertical distribution, shows that this contention is at least largely true. The abrupt termination of the forest on some of our mountain heights, whether high or low—as for example on the Rocky Mountains or on Mt. Katahdin—and the continuance of trees of still noble proportions practically to the very limits of disappearance, point very strongly to this conclusion, a conclusion which is further supported by the reappearance in many places (of the same region) of the identical forest in positions considerably



perpetual snow is the determinant of absolute or greatest elevation, but this is not strictly the case. Thus, it is well known that in the Swiss Alps phanerogamic plants are found nearly 2700 feet above the snow line; the beautiful mountain pink (*Silene acaulis*) has been met with at an elevation of 11,382 feet,* and *Androsace glacialis*, a primulaceous plant, at 11,406 feet, on the Piz Linard (Grisons). Indeed, Heer has determined not less than a hundred species (or approximately that number) of flowering plants (representing twenty-three families) as growing on the Rhætic Alps above the snow line (9060 feet), and Martius has recorded twenty-four species from the Grands Mulets, Mont Blanc, on elevations ranging from 10,540 to 11,300 feet.†

So far as the Mexican summits are concerned, I think it may be safely asserted that the tree or timber line is not an absolute one; in other words it is not one which is determined by the natural conditions of growth of the plant itself, but rather it is dependent upon purely local causes. It is scarcely conceivable, for example, that on Orazaba, where at an elevation of upwards of 13,200 feet the trees were still 30–40 feet in height, an additional 500–600 feet should so materially alter favorable (climatic) conditions of growth into unfavorable ones as to produce extermination; indeed, we must assume that this change is even much more rapid, for at the very verge of the timber line the pines, although necessarily harboring a considerable number of small specimens, still easily measured 20–30 feet. This condition we found repeated on Popocatepetl and Ixtaccihuatl, most markedly, perhaps, on the latter mountain; I am positive that some of the uppermost pines here, very close to the disappearing line, were not less than 40–50 feet high, if not higher. Again, on Popocatepetl, as has already been remarked, the timber line ceases a little above 13,100 feet, the trees themselves being of rather inconsiderable height. On an equivalent height on a spur of the Sierra Tlamacas,‡ however, the pines are still noble foresters, and on the Sierra Tlamacas itself, off in the direction of Ixtaccihuatl, they rise to elevations several hundred feet higher. There is little doubt in my mind that the actual limitation on the summits here referred to is mainly determined by such physiographic conditions as steepness of slope, downwash of soil, exposure to the cold waters of melting snows, storms, etc. How much higher, under more favorable conditions, the tree line might have attained, I am unable to say; but it is interesting to note that such as it is, it is virtually the most elevated tree line in the world. §

* Humboldt, "Views of Nature," p. 318. I met with this plant (summer of 1891) in various parts of Greenland, between lat. 69° and 77° 40′, growing from the sea-level to an elevation of 1500-2000 feet.

† Grisebach, *op. cit.*, i, p. 167.

‡ Crossed just before reaching the ranch of Tlamacas.

§ This statement, perhaps, requires modification. Pöppig, from manuscript data submitted to him by Engineer Benjamin Scott, asserts ("Reise in Chile, Peru and auf dem Amazonenstrome," ii, p. 80) that on the Peruvian Andes, near the hamlets of Huaylillas de Potosi and Uchusuma, treelets of (?) *Polylepis racemosa* are found at elevations of 15,883

In the north temperate regions the timber line, where marked by the disappearance of conifers at all, seems to characterize indiscriminately the zone either of pines or firs (spruces); probably in the greater number of instances the latter are the most far-reaching trees. In the Harz mountains, the Riesengebirge, the Böhmerwald, the Jura mountains, and in many parts of the Alps, Carpathians and Pyrenees the firs are the delimiting zone of forest; but again, in other parts of the Alps and Pyrenees, in the Tátra (Central Carpathians), the Altai, and on many of the mountain crests of the Mediterranean region, the pines (notably *Pinus cembra*) considerably overtop the firs, even if they do not form that distinct vegetal zone which is constituted by the latter. In North America, perhaps even more than in Eurasia, do the firs constitute the uppermost coniferal zone, a zone which is so eminently defined on the higher elevations of the Appalachian system of mountains (White mountains, Black mountains of North Carolina). In the Rocky mountains the pines and firs both attain the timber line, but the latter predominate by far as a zone-making element; indeed, on many of the more elevated summits the pines only sporadically mingle in with firs. It is the more interesting, therefore, to find that on the still higher summits of Mexico the reverse order obtains. The zone of firs (consisting of *Abies religiosa*), as I had occasion to observe on Orizaba, Popocatepetl, Ixtaccihuatl and the Nevado de Toluca, virtually ceases at about 11,500–12,000 feet,* or two thousand

and 15,918 feet, or nearly 150 feet higher than the *Saxifraga Boussingaulti*, from the slopes of Chimborazo, which Humboldt considered to be "the highest growing phanerogamic plant in the world" ("Views of Nature," p. 234). Again, Humboldt himself observed occasional specimens of tree-like Verbesina on Pichincha at an elevation of nearly 14,400 feet ("Kleinere Schriften," p. 57). It seems likely that the measurements of altitude in both of these cases are given too high a value; at any rate, the more recent surveys of the



feet below the line of the pines, and yet more below that of the last junipers.*

We observed the last specimens of this genus (*Juniperus tetragona*) covering the bare rocks of Orizaba at some little distance beyond the actual tree line. It is not always easy to determine just what are the causes which operate towards establishing and regulating the succession of special vegetal zones on mountain slopes any more than it is possible, in our present knowledge, to explain the anomalies of succession on the horizontal plain stretching towards the Pole. The law of parallelism in horizontal and vertical succession, which Humboldt first formulated, and which was founded on the perception of climatic influences almost alone, while it touches the broader aspects of the problem, does not essentially explain the detail; nor can it be said that the modification of this law, defined by an excess or decrease of solar illumination, the horizontality or verticality of the solar rays, etc. (as elaborated by Wahlenberg, Grisebach and others), any more explains the special contradictory features of this distribution. Preoccupation or first possession of a region by a special group of plants has doubtless much to do with the problem; it is an important factor towards determining supremacy, and must, therefore, largely regulate the outcome from a competitive struggle for existence.

The oaks of the Mexican volcanoes occupy the lower pine belt, ranging to about 10,000 feet. We obtained three species on Orizaba—*Quercus reticulata*, *Q. Orizabæ*, and a third form which we have not yet been able to identify. Above 8000 feet they are comparatively rare and no longer form forests, such as are to be met with in the lower region of 4000–6000 feet. In the more or less open dustcountry below the pines—*i. e.*, below where the pines appear on the western slope of Orizaba, about 9000 feet—they are still fairly abundant, forming groves and copses, but once entering the pines they appear only as stragglers. The same condition prevails on Popocatepetl and Ixtaccihuatl. Associated with the oaks are one or more species of alder, *Alnus Jorullensis* and *A. castanifolia;* we found the former a tree of some 15–20 feet height, extending up to 12,000 feet or more. The second form, which is now generally looked upon only as a variety of *A. Jorullensis*, and which we found on Popocatepetl at an elevation of about 11,000 feet, is a member of the flora of the Peruvian Andes—one of the very few plants which are common to the two regions.

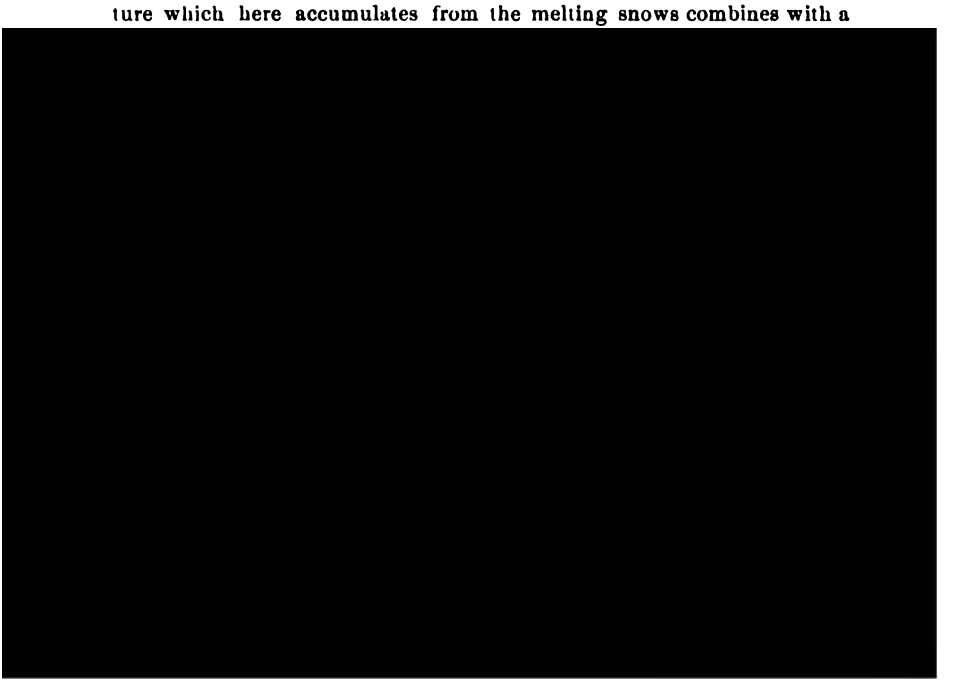
As regards the non-arboreal vegetation of the Mexican summits, the list of species given at the beginning of this paper sufficiently illustrates

a very much lower altitude than where we actually observed it; indeed, it appears that Humboldt and Boupland met with it not far from the forest of Chilpanzingo, south of the Mexican plateau, at an elevation of barely more than 4000 feet.

* It is true that Schiede mentions the tree as rising to the timber line on Orizaba (Parlatore, in De Candolle's "Prodromus"), but I believe the statement to be erroneous. Galeotti's observations, which accord almost exactly with my own, place its limit at some 12,200 feet. Hemsley, on the other hand, reduces the elevation to 10,500 feet, a figure which is 1500 feet too low.

its character. A few remarks from personal observation may not, however, be amiss. We found the most varied flora—*i. e.*, in the region above 8000 feet—on Popocatepetl, and it was here, too, that the vegetation presented itself in its most luxuriant aspect.* Taking the physiognomy of the four summits into one general consideration, it may be said that the most noticeable or distinctive plants are two or more species of Senecio and a lupine (*Lupinus vaginatus*). The yellow flowers of the former and the blue of the latter were an ornament to the vegetation almost everywhere between 10,000 and 12,000 or 13,000 feet. *Senecio chrysactis*, a graceful plant 3–4 feet in height, reaches the limit of pines on all four of the loftiest summits, rising somewhat higher, seemingly, than *S. Galeottii*.

These yellow "asters," with the tall lupine, form a compact undergrowth to the upland pines, especially where the latter have been in one way or another thinned into groves, leaving patches of open country in their midst. In such localities the vegetation is truly luxuriant, and the eye is charmed by the brilliancy of color which is everywhere manifest. The horseman traverses a flowering prairie with his animal buried to its flanks in the rank growth ; on Popocatepetl, more particularly, is this the case. Above 13,000 feet we found the greatest number of species in flower on Ixtaccihuatl. Here, immediately about our night's camping ground, at an elevation of approximately 13,200 feet, we found a veritable garden. The ground was decked with a profusion of the blood-red *Castilleja Tolucensis*, the carmine *Echeverria gibbiflora* (or *E. secunda?*) and the yellow *Ageratum arbutifolium*, while from the rock-fissures protruded tufts of *Asplenium trichomanes* (var. *majus*)—the only fern we were fortunate enough to secure for our collections—and partially concealed masses of *Chionolæna lavandula*, *Phacelia pimpinelloides*, etc. The moisture which here accumulates from the melting snows combines with a



Among the more distinctive vegetal features of the lower volcanic slopes may be cited the dense bushes or thickets of *Arbutus spinulosa* and (the rigid) *Symphoricarpus microphyllus*, which border the rough mule-ways for long distances at (approximately) the 11,000-foot level, characterizing there a partial zone of their own. We found the ericaceous plants particularly abundant on Popocatepetl. With them is associated the magnificent red-flowering honeysuckle (*Lonicera filosa*), a stately plant 4–6 feet in height, which is certainly one of the most attractive growths of the region. To this zone succeeds a belt of composites, characterized by a special development of *Baccharis concava* and *Erigeron maximus*. It need hardly be said that the zonal lines—if, indeed, they are really worthy of such characterization—are not well differentiated; the plants of different belts mix in well with one another, so that everywhere there is considerable overlap. Nor do the same plants always occupy the same positions on the different mountains. Still, an approximation to zonal separation is to an extent manifest, especially where the maximal development of any series of plants is reached.

One of the most beautiful plants of the roadside, most abundant, perhaps, between 11,000 and 12,000 feet, is a pink evening primrose (probably *Œnothera tetraptera*) with flowers somewhat smaller than those of a rose; the plant can, indeed, be appropriately designated the "alpine rose" of the Mexican mountains, as it is not unlike in general appearance a wild rose, though provided with only four petals. Its showy blossoms constitute one of the glories of the mountain roadways, but it is not entirely absent from favored open spots of the lower regions. We met with the plant abundantly in the meadows about Patzcuaro, at an elevation barely exceeding 7000 feet. Here it was associated with *Jussieua repens*, *Cuphea procumbens*, *Sisyrinchium micranthum* (?), *Baccharis conferta*, etc.

The preponderating element in the upper Mexican flora is made up of forms which distinctly represent the temperate and Arctic regions, and not of modifications (suited to a more rigorous climate) of the lower or basal floras of the same region. This is the condition which is found to characterize the high mountain floras of tropical regions generally, as distinguished from those of temperate climes, and for reasons which have been well pointed out by Engler in his exhaustive treatment on the development of the vegetable world.* Most of the Mexican plants occurring above 10,000 feet, while they are to a very great extent congeneric with the forms of temperate North America, are specifically almost wholly distinct. Indeed, the relationship with the plants of the much more distant Andean summits, so far as the recurrence of identical specific forms is concerned, appears to be considerably more intimate than it is with the forms belonging to the north. The reason for this is to me at the present time entirely conjectural.

* "Versuch einer Entwickelungsgeschichte der Pflanzenwelt," ii, 1882.

The following species are found on the Andean summits from New Grenada to Peru or Bolivia:

Ranunculus Peruvianus.
Sisymbrium canescens.
Cerastium Andinum.
Arenaria alsinoides.
Colobanthus Quitensis.
Trifolium amabile.
Alchemilla orbiculata.
" Sibbaldiæfolia.
" tripartita.
" hirsuta.
Acæna elongata.
Ottoa œnanthoides.
Tauschia nudicaulis.
Lobelia nana.
Halenia elata.
Saracha umbellata.
Mimulus glabratus.
Veronica serpyllifolia.
Alnus acuminata.
" Jorullensis.
Sisyrinchium scabrum.

—about ten per cent. of the entire flora. In view of the distance which separates the two regions—some 900 to 2400 miles—this is, after all, not such a small number; indeed, the wonder is rather that so many alpine forms should have found it possible, in the region of the tropics, to cross



The assertion of Orozco y Berra that they were also called *Tenez* arose from a misunderstanding of the letter of Hernando de Barrientos to Hernando Cortes (1521). Barrientos was not among the Chinantecs proper, but in another *chinamitl* in Chiapas.* Still other *Chinanteca* are mentioned as resident in Nicaragua. This Nahuatl word has absolutely no ethnographic significance.

Several authors have confounded these Chinanteca with the "Tzinacanteca," or Bat-people, a Maya tribe in Tabasco and Chiapas. The two are nowise related.

Location.—Their country was located in the mountains of the eastern portion of the State of Oaxaca and on the frontiers of the present State of Vera Cruz. Their neighbors on the north and east were Nahuatl-speaking tribes, on the south the Zapotecs and Mistecs, and on the west the Mazatecs and Cuicatecs, the latter supposed to be a distant branch of the Zapotec stock. Within these boundaries was a wide variety of climate, ranging from the torrid vales of the *tierra caliente* up to the chilly regions of the high sierra, where we find one of their villages with the significant name "Holy Mary amid the Snows," Santa Maria de las Nieves. The village of Chinantla itself is situated in a wild and mountainous district where the climate is cool and rainy.† Orozco y Berra gives the names of thirty-four other towns inhabited by them.

History.—The Chinantecs are an extremely ancient people who have resided on the spot where the Spaniards found them from the earliest period of the traditional history of Mexico. We first hear of them as having been conquered by Ahuitzotzin, ruler of Mexico. This event according to the chronology of Torquemada, who is our authority for it,‡ took place in the year 1488.

They were treated by their conquerors with the utmost severity and cruelty, of which the historian Herrera cites several instances.§ They were glad, therefore, on the appearance of the Spaniards to throw off the yoke of the Mexicans and lend their aid to the invading strangers.

Culture.—The Chinantecs are described as a rude savage people, living in huts constructed of branches of trees, and devoid of the culture of their neighbors on either hand, the Zapotecs or the

*See the letter of Barrientos in the *Cartas y Relaciones de Hernando Cortes*. Edition of Don Pedro de Gayangos, Paris, 1866, pp. 204, 205 and notes.

†E. Mühlenpfordt, *Mexiko*, Bd. ii, s. 214.

‡Juan de Torquemada, *Monarquia Indiana*, Lib. ii, cap. lxiii.

§*Historia de las Indias*, Dec. iii, Lib. iii, cap. xv.

Nahuas. Their principal weapon is said to have been lances of unusual length which they handled with singular dexterity.

Literature.—The first to reduce the Chinantec language to writing was Brother Francisco Saravia. He was a native of Seville, in Spain; by trade a cabinetmaker, in that capacity he emigrated to the City of Mexico, where he married and carried on a prosperous business. The death of his wife, when he was about thirty-five years of age, led him to renounce the world, and in 1574 he joined the order of Dominicans. Having been assigned to the province of Oaxaca, he devoted himself to studying the language of the Chinantecs, and in collecting them from the caves and ravines in which they lived into villages where they could cultivate the soil. His success was great, and the natives regarded him with equal love and reverence. For fifty years of his long life he labored among them, and when he died in 1630, at the ripe age of a nonagenarian, he left in the archives of his order a number of MSS. in and upon the language. Of these we have the titles of a *Catecismo*, an *Arte*, a *Confesionario* and *Sermones*. Probably the most important was his *Gran Homilario Chinanteco*, a copy of which he placed in every one of the parishes under his care, so that the native sacristan could read the homily when the priest should be prevented from attending. More interesting to the historian doubtless was his autobiographical sketch of the tribe written under the title *Noticia de la Conversion de la Nacion Chinanteca y sucesos acaecidos en ella al*



upon it, which have also been of some service to me, although they are quite fragmentary.

The tongue is not included in Pimentel's *Cuadro Descriptivo de las Lenguas Indigenas de Mexico*, and there is no specimen of it accessible to students of linguistics. It appears, therefore, worth while to present a short description of its character; the more so as this seems different from many American tongues on account of the singular simplicity of its construction. In fact, I entertain some doubts whether Barreda's version represents correctly the idiom in its pure form. It certainly reveals no such difficulties as he speaks of, and resembles strongly a jargon in which inflections and syntactic relations have been reduced to their lowest terms. Several of the translations of the early missionaries have proved, on examination, to be in a jargon or trade language of a tribe, and not in its real speech. This may be the case here.

The Language.—The Chinantec tongue appears to have no affinity with any of its neighbors. It is described as guttural, rough in enunciation and difficult to learn. Barreda says in his Prologue that many of the priests assigned to parishes in the nation tried in vain to acquire it, and, failing in this, attempted to introduce the Nahuatl among the Chinantecs; and that this proving a failure, had asked for other fields of labor. He himself, after twenty years of study, had succeeded but moderately in mastering it, but adds that he had exercised the utmost care in translating the *Doctrina*, submitting every word in it to the most intelligent natives of his parish. The dialect he employed was that of Yolos, which differed, but not greatly, from that of other portions of the nation.

The pronouns are but slightly developed—a fact in marked contrast to most American tongues. The same form serves for both the personal and the possessive pronouns, and it is probable that there is no distinction between their singular and plural number, although a slight difference is sometimes indicated.

PRONOMINAL FORMS—PERSONAL AND POSSESSIVE.

I,	*na.*	We,	*nah.*
Thou,	*no.*	You,	*no.*
He,	*quia.*	They,	*quiaha.*

It is noteworthy that the pronoun of the third person, *quia*, may be used for either the second or the first in its possessive sense; thus,

vi chaaqui quia, "for his sins," instead of *vi chaaqui na*, as a translation of "for my sins." So again, *animas quia*, as a translation of "our souls." This is analogous to the language of children, who do not clearly distinguish persons, and often refer to themselves in forms of the third person instead of the first.

The interrogative is *he*, which also serves as a relative, and with the addition of the adverb of place, *la*, here, forms the demonstrative, *hela*, this, as *hela cna in*, "this first one." The demonstrative "that" is usually given by *da* or *nda*.

The indefinite pronoun *cha*, some, some one, somebody, is frequently prefixed, often apparently in a collective or distinctive sense, as *chañuh*, "some man" or men, *i. e.*, people in general; *charuhno*, "thy neighbor;" *chazaquiun*, "somebody bad"—the devil; *chajhian*, "somebody else."

In all cases the possessive pronouns are suffixed to the nouns.

The verbal forms appear to vary considerably. A terminal *e* or *a* appears to mark the infinitive, as *pane*, to chastise; *ngueihna*, to kill. The imperative is characterized by the pronoun, as

Phua ha cala phua na.
Say thou as say I.

The reflexive has the pronoun before and after the verb:

Na juanih na.
Me bow I.
(I bow myself.)



In, *no;* as, *no toho,* "in the belly;" *no caliz,* "in the calix" (sacred cup); *no chaaqui,* "in sin."
On, *ni;* as, *ni altar,* "on the altar;" *ni muicui la,* "on this world."
Into, *lei;* as *hiñi lei gotan tan vino lei muian,* "(the) bread into flesh and (the) wine into blood."
Before, in the presence of, *quiani;* as *quiani jhian quecha,* "before other persons." Before, in time, *gean.*
After, in time, *quéin.*

Conjunctions.

And, *tan.*
Also, *jalabajna;* as, *jalabajna na ñina,* "also I am poor."

Numerals.

	Cardinals.	*Ordinals.*
1	*cna,*	*hela cna in.*
2	*tno,*	*hela tno in.*
3	*nne, nei,*	*hela nne in.*
4	*quiu,*	*hela quiu in.*
5	*ña,*	*hela ña in.*
6	*ñiu,*	*hela ñiu in.*
7	*nyaa,*	*hela nyaa in.*
8	*ñna,*	*hela ñna in.*
9	*ñu,*	*hela ñu in.*
10	*nya,*	*hela nya in.*
20	*nyanya.*	
40	*tno laa.*	
50	*tno laa nya.*	
60	*nne la.*	
70	*nne la nya.*	
80	*quiu la.*	
100	*ña la.*	
200	*nya la.*	

Texts.

The Lord's Prayer.

Phui ñuhu nah ñujui quinno, qualin cuiá hela xi-no; quœhe
Lord father our heaven it in, may blessed that name-thy; come
nah ñujui quiehe; quali heli hahà muycuila, jalabajna ñujui; quœhe
us heaven thy; may that will earth on, also heaven; give
hi nah chaháchahá, tan ih-no chaaqui quiee nah, can jhiula in nah
bread us all the time, and wilt-thou sins forgive us, just as we

chazaquiun quiani nah; tan za ton-no nah qûehi vi chaaqui; qui mi nah
sins pardon against us; and not thou us bring to sin; take us
phui Dios geila he zaquiu.
Lord God all this evil from.

Extract from the Doctrina of Barreda.

Porque se hizo hombre el hijo de Dios?

He vi caleñuhne Jna Dios?

Por librarnos de los manos del Demonio, y por redimir nos del pecado.

Vi caquinne nah quaacha lin, tan vi caquinne nah ni chaa qui.

Que hizo Nuestro Señor Jesu-Christo para librarnos?

He camea phui nah Jesu Christo, vi caquinne nah?

Padeció muchos tormentos, fué crucificado, murió y fué sepultado.

Cangûinne ñule Juahui, cajanqua ni cruce, cajone, can cahanne.

Que hizo nuestro Señor Jesu-Christo despues que murió?

He camea phuinah Jesu Christo, qua male jonne?

Al tercero dia despues que murió, rescuscitó, y á las quarenta dias despues que resuscitó subió á los cielos y se sentó á la mano diestra de Dios padre todo poderoso.

Nne mui qua male jonne, cagnihi, tan tno la mui qua male cagnihi cangaa na ñujui, tan cahuiaà quaa cha Dios mii geilaha li mea.

Viendrá otra vez nuestro Señor Jesu-Christo á este mundo?

Nijhea que tno phui nah Jesu Christo, mui cuila?

Otra vez hà de venir quando se acabe el mundo, á tomar cuenta á

Cna que, nijhea mui cha in mui cui, jhea quià quenta geilan cha xan,

[redacted]

Quando muere la gente en este mundo, tambien mueron sus almas?

No mueron sus almas, sinó solamente el cuerpo muere; porque no puede morir el alma.

Y cuando muere el cuerpo, muere para siempre?

No puede morir para siempre, porque el dia que se acabe el mundo, resuscitaran todos los cuerpos, y se juntaron con sus almas, ya para nunca mas morir.

Adonde van las animas de los defuntos quando mueren sus cuerpos?

Las animas de los buenos van al cielo para siempre, porque guardaron bien lo que manda la ley de Dios; y las almas de los malos van al infierno, porque no guardaron bien lo que manda la ley de Dios.

* * * * *

Que es cielo?

Cielo es un lugar lleno de mucho y grande gloria; lleno de todo genero de bienes, y de todo genero de alegria, en donde está Dios nuestro Señor, la Santissima Virgen, todos los Angeles y todos los Santos. Allí van las almas de los buenos que sirvieron à Dios à descansar para siempre, que nunca se podrá acabar.

Ma jonnencha muicuila, jabala jna jon anima quiaha?

Aza jon anima quiaha, ma jna la ha gotamba jonne; vi aza li jon anima.

Tan ma jonne gotan, jonne cnaphue?

Aza li jonne cnaphue geila muiba, vi quiaha mui cha in muicui, jna tno nigni cala geila gotan, tan nigni cnaha animas quiaha, vi aza jua cna li jonne.

Jhia cha animas cha jon ma jonne gotan quiaha?

Animas chaqui vn cha ñu jui geila muiba, chavi hah quiu he quiu hu tà ju quiaha Dios; tan animas cha zaquiun cha nya jui, chavi za hah quiu he quiu hutà ju quiaha Dios.

He ñu jui?

Nujui cna namba, canlè ñu phueli gloria, canlè cala geila juayanchij, thia nhuiaa phui nah Dios, xa ñujui, geilan angelcs, tan geilan santos. Nda cha animas chaquiun, cha camea ta quiaha Dios, ma hine cala geila muiba, aza jua li chan.

English-Chinantec Vocabulary.

Alive, *chaxan.*
All, *geila, geilan, lagei; geila hejna,* "all these things;" *geila balimea,* "all-powerful."
And, conj., *tan.*
Bad, *asaquiu, zaquiu, chaaquiu* (= not good).
Because, *chavi.*
Believe, to, *changa.*
Belly, *toho;* "in the belly of the virgin," *ño toho xa muinne.*
Bird, *ta.*
Blood, *muian, muien;* "by the blood," *muien no* (*mui* = water and woman).
Body, *gotan;* "in body and soul," *gotan tan anima quiaha.*
Boy, *quana.*

Bread, *hiñi.*
Breast, *chij.*
Brother, *run.*
Child, *yun.*
Day, *muiba.*
Dead, *ma-jon, cha-jon.*
Devil, *zaquiun* (see "bad"); *chalin* (see "sick").
Die, to, *jon-ne.*
Drink, to, *nguhu.*
Ear, (*la*)*quaha.*
Earth, *muycui.*
Eat, to, *cuhu.*
Eye, *manihi.*
False, a lie, *azacha* (= not true).
Father, *ñuh* (= man); *mii; Dios mii,* "God the Father."
Fire, *gêi.*
Foot, *tehi.*
Full, *canlé.*
Girl, *mui yun* (= female child).
Give, to, *quæ, quæ he.*
Good, *quiu.*
Grandfather, *nyuh.*
Grandmother, *nyaa.*
Great, *phue;* superlative, *ñu phueli.*
Hand, *quaha;* "open thy hands," *janquaha!* "In thy hands I
Know, to (conocer), *cuih.*
Kill, to, *nguethna.*
Live, to, *xan.*
Magician, *gin.*
Make, to (Span. hacer), *mea.*
Man, *ñuh, cha-nu*
Meat, flesh, *gno.*
Money, *cu.*
Month, *zei.*
Moon, *zei.*
Mother, *xa, xaha.*
Mountain, hill, *maa.*
Much, *ñu, ñule.*
Name, *xi; hi xi no?* "What (is) thy name?"
Nephew, niece, *nyaa.*
No, *aza, za.*
Nothing, *aza-he.*
Now, *na.*
Or, *qua.*
Pay, to, *qui-hi, quei.*
Place, *namba.*
Poor, *ñin, ñina.*
Pudenda feminæ, *yuh.*
Pudenda viri, *cnu.*
Relation, a, *ruh, run* (= brother).
Shoulder, *cà.*
Sick, *chah.*



With, *cnaha.*
Wizard, *lan.*
Woman, *mui, cha-mui.*
Word, *ju; cna ju,* "one word"
Work, to, *ta.*
Year, *gni.*
Yes, *xa, jna, ma* (*ba* = it is).

On the Mazatec Language of Mexico and its Affinities.

By Daniel G. Brinton, M.D.

(*Read before the American Philosophical Society, January 15, 1892.*)

In the northeastern corner of the State of Oaxaca lies a mountainous tract, watered by numerous streams, known from earliest times by its Aztec name *Teutitlan,* the Divine Land, or The Land of the Gods, and officially now as the district Teutitlan del Camino. It has about 26,000 inhabitants, a large proportion of whom are of native blood. These speak three radically different languages—the Cuicatec, which is probably a dialect of the Zapotecan stock; the Chinantec, which stands alone, and the Mazatec, of which nothing whatever has been known, and which it is my aim to examine and, if possible, classify in the present study.

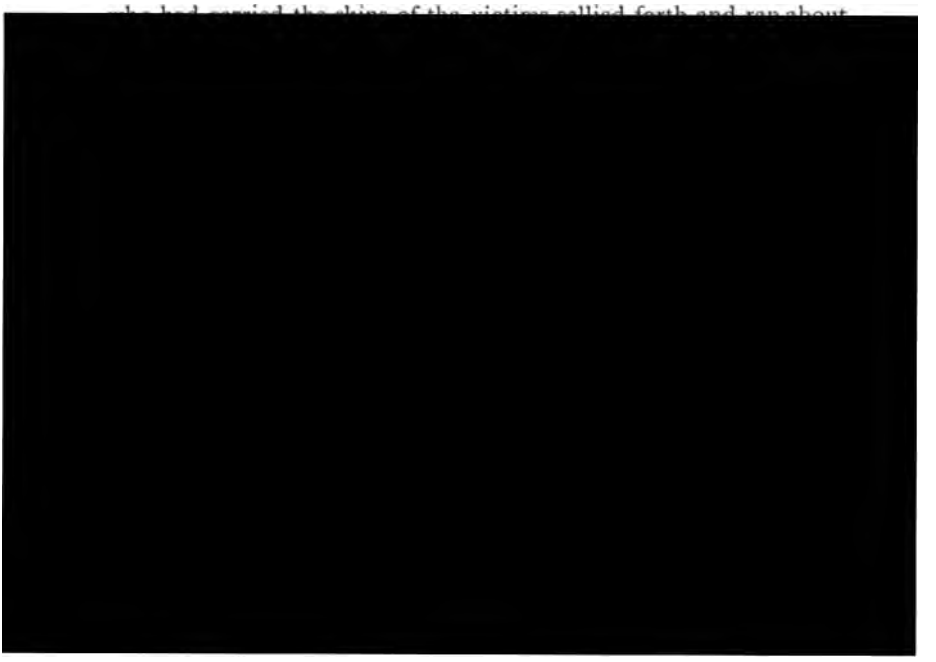
The material I have for the purpose is an unpublished vocabulary, collected by a Danish officer, who was in the service of Maximilian, and which has been obligingly furnished me by Mr. Alphonse Pinart, whose extensive researches in American linguistics are well known. The only published materials in existence are two translations of the Lord's Prayer into different dialects of the tongue. These have been reprinted by Pimentel, Bancroft and other writers. Their precise provenance is unknown; as for the vocabulary, it was obtained at Huantla, northeast of the town of Teutitlan.

Names.—The name Mazatecatl—plural, Mazateca—means "Deer People" in the Aztec or Nahuatl language. It may have been given them by their Nahuatl neighbors on account of their land abounding in deer; or, as some say, because they worshiped the figure of a deer—that is, had a deer totem among them. There were other Mazatecas living in the present State of Tabasco, and yet others in the State of Guerrero; but we have no reason to suppose that those "Deer Peoples" were at all related to these in Teutitlan. What they called themselves, if they had a collective tribal name, we do not know.

Nor is it certain why their country was referred to by the Aztecs as "The Land of the Gods." It seems likely that it was on account of the numerous temples that existed there, and the unusually devotional character of the natives. The remains of these ancient religious structures and of the artificial mounds which supported them still bear witness to this, and two of their villages yet bear the names San Antonio de los Cues and San Juan de los Cues, the term *cues* (a Haytian word) being applied by the Spaniards to artificial mounds. The former is situated in the valley of the Rio Salado; the latter in an adjacent valley. Unfortunately, no archæological exploration of them has been reported.*

Their religious character is also referred to by the early Spanish writers. Sahagun describes them as performing remarkable tricks at certain festivals, such as swallowing live snakes and frogs.† Mendieta speaks of their rigid fasts and abstinence from marital relations for fifteen days after the nuptials. The historian Herrera gives the following description of some of their rites:

"In the Province of Teutitlan, where the Mazatec language is spoken, which adjoined that of the Mistecs, they were accustomed to flay the sacrificial victims, and carried the skins to the neighboring villages, asking alms. On the day of a certain important festival, which took place annually, the priests ascended the temple and struck a war drum. At this signal all the Indians who were in the fields had to run to their houses and their town. Then those



This Xelhua was a mighty man—one of the "Giants,"—and was surnamed the Builder, for he it was who constructed the famous Pyramid of Cholula. He is also referred to as chief of the Olmeca, an unknown, ancient people.

We need attach little importance to these old stories, and will find it more profitable to turn to the language of the Mazatecas to discover their affiliations.

In investigating its possible analogies with other idioms, I have been somewhat surprised at the relationships which it certainly discloses. These are not with the Zapotec-Mixtec stock, as I have (erroneously) stated in my work, *The American Race*,* but with two quite remote and independent stocks.

The one of these is the Chapanec, which was spoken in the present State of Chiapas, and also at the time of the conquest by many thousand natives, who occupied the shores of Lake Managua and Fonseca Bay, in Nicaragua, where they were known as Mangues and Orotinans. The dialects of this stock are closely akin to each other.

The second list of affinities point to a still more remote and unexpected relationship. The Mangues had as neighbors beyond the Cordilleras, in Costa Rica, a group of related tribes—the Talamancas, Borucas, Bribris, Vizeitas, etc., whom I shall call, collectively, "Costa Rican." These have been satisfactorily shown by Dr. Max Uhle, Dr. A. Ernst and other students to be not distantly connected with the important Chibcha stem of New Granada, which, at the conquest, was widely extended over that Province, and is the only linguistic stock of South America whose presence in North America has been proved.†

After presenting the vocabulary furnished me by Mr. Pinart and the texts offered by Pimentel I shall pursue the comparisons of the stock of terms thus supplied.

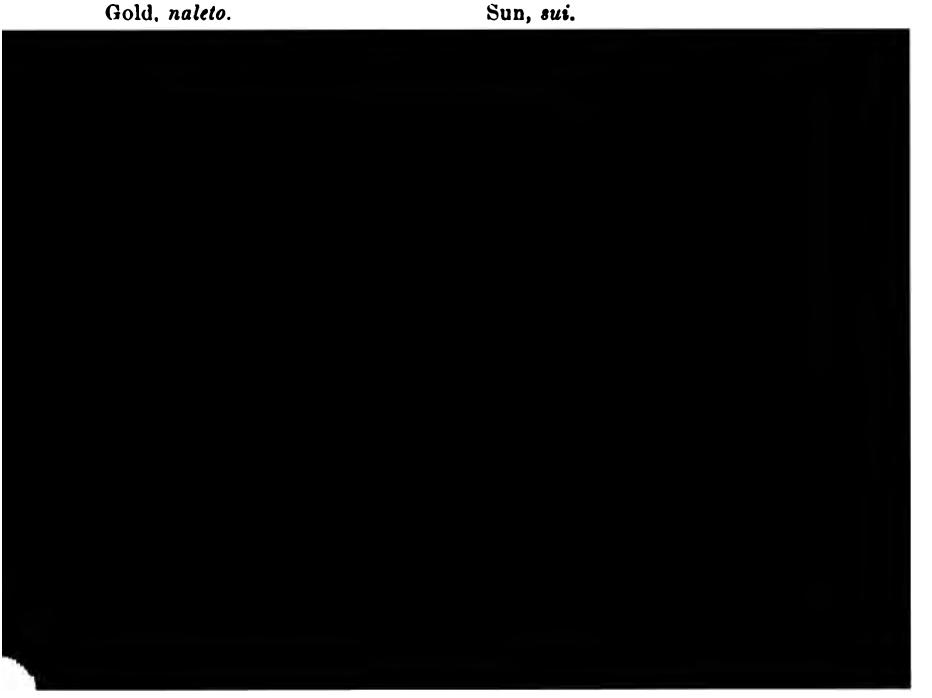
English-Mazatecan Vocabulary.

Arm, *chale.*	Black, *twna.*
Bad, *minda.*	Blue, *iso.*
Banana, *nacha'.*	Boy, *indidi* (see "Son").
Beans, *nahma'.*	Bread, *chu hi.*
Beard, *tsa' á.*	Breast (chest), *animale.*

* *The American Race: A Linguistic Classification and Ethnographic Description of the Native Tribes of North and South America*, p. 142 (New York, 1891).

† See *The American Race*, pp. 184-186.

Brown, *schene'*.
Cactus, *nan' da*.
Cat, a, *chito*.
Chief, *chicunai*.
Church, *inai*.
Clothing, *nikye*.
Clouds, *ifi*.
Cow, *ngchaha'*.
Daughter, *tzadi* (see "Girl").
Day, *gunichi*.
Dead, *coviu*.
Die, to, *cuiyane*.
Dog, *nanya*.
Door, *chutoa*.
Ear, *schical*.
Earth, *nangi*.
Egg, *cho'*.
Evening, *gischo*.
Eye, *schca*.
Eyebrows, *tza ixpan* (?).
Father, *tata*.
Finger, *noon-tza* (see "Hand").
Fire, *nii*.
Foot, *tzócó*.
Forehead, *ten*.
Girl, *tzadi*.
God, *naina'*.
Gold, *naleto*.
Meat, *yoje*.
Money, *to*.
Moon, *sa*.
Morning, *tanhya*.
Mouth, *tzoa*.
Night, *nhyu*.
Nose, *nitu*.
Onion, *tutso*.
Palm, *schahe'*.
Paper, *schuhu'*.
Plantain, *nacha'*.
Plaza, *titzi*.
Pretty, *da*.
Rain, *tzi*.
Red, *ini*.
River, *dahoe*.
Road, *diya*.
Sea, *dachicu*.
Sheep, *chitzanga*.
Sierra, *gihya*.
Silver, *tonschua*.
Small, *tua*.
Snow, *dandya*.
Son, *indi* (see "Boy").
Star, *ningutzea*.
Stone, *noyo*.
Summit, the, *garonindo*.
Sun, *sui*.



The personal pronouns are:

I, *gāa'*.	We, *gahi*.
Thou, *gahye'*.	You, *gahini*.
He, *he*.	They, *niahne'*.

Of the possessives I find the following:

Mine, *na*.	His, *le'*.
Thine, *li*.	Our, *nahan*.

The numerals are given thus:

1	*go'*.	8	*hi*.
2	*ho'*.	9	*nyaha'*.
3	*ha'*.	10	*te*.
4	*nihu'*.	11	*tengo*.
5	*ŭ*.	15	*chu*.
6	*hŭ'*.	20	*cung*.
7	*yato'*.	30	*kate*.

There are two versions of the Lord's Prayer given in Pimentel's *Cuadro Descriptivo de las Lenguas de Mexico*. They evidently have been made by different persons, and represent different dialects of the tongue, and apparently neither is in that of Huantla, where the vocabulary was obtained. Both, however, are clearly Mazatec, and the differences disappear considerably on analysis.

They are as follows:

A.

"Nadmina naina ga tecni gahami; sandumi ili gatirrubanajin nanguili; cuaha catama janimali, jacunit dic nangui cunit gahami; niño rrajinna tey quitaha najin: qntedchatahanajin gadchidtonajin jacunitgajin nedchata alejin chidtaga tedtunajin: guquimittacuntuajin, tued tinajin cuacha catama."

B.

"Tata nahan, xi nacá nihaseno: chacua catoma ñiere: catichová rico manimajin: catoma cuazuare, donjara batoó cornangui, bateco nihasen: niotisla najin ri ganeihinixtin, tiuto najin dehi: ni canuhi ri guitenajin donjara batoo, juirin ni canojin ri quiteisajin: quiniquenahi najin ri danjin quisanda nongo niqueste Meé."

Referring to the first as A and the second as B we may make the following comparisons with words in the Vocabulary:

	A.	B.	Vocab.
Our,	*naina,*	*nahan,*	*nahan.*
Father,	*nadmina,*	*tata,*	*nami* ("cura").
Thou,	*ga,*	*nacá,*	*gahyé.*
Heaven,	*gahami,*	*nihaseno,*	*gami.*
Earth,	*nangui,*	*nangui,*	*nangi.*
Kingdom (thy),	*janima-li,*	*manima-jin.*	
Give (thou),	*niño,*	*nio-tisla.*	
To-day,		*ganei,*	*gandai.*
Us (= to us, of us),	*najin,*	*najin.*	

Turning now to an investigation of the affinities of the Mazatecan, I present the following arrangement of a number of words, with their corresponding terms, in dialects either of the Chapanecan or Chibchan stock. It is noteworthy that very rarely do we find any word which is at all alike in the three. The Mazatecan terms seem to have been derived from two sources radically dissimilar.

Comparison of the Mazatec with the Chapanecan and Chibchan Stocks.

			Chibchan.	
Mazatec.	Chapanecan.	Costa Rican.	New Granadian.	

[redacted]

			Chibchan.	
	Mazatec.	Chapanecan.	Costa Rican.	New Granadian.
Hand,	*tza,*			*yta.*
Head,	*tku,*	*θokua.*		
Here,	*ihndi,*	*jande.*		
Hill,	*nindo,*	*ndili.*		
Hilltop,	*garomindo,*	*namando.*		
Lightning,	*kuata,*	*koita-pumene.* (thunder)		
Maize,	*nama,*	*name.*		
Man,	*chii,*		*hechiche.*	
Money,	*to,*	*tu-mi.*		
Moon,	*sa,*		*só, sie,*	*za* (night).
Mouth,	*tzoa,*	*duŭi.*		
Mountain,	*gihya,*	*gua.*		
Night,	*nhyu,*	*nyufui.*		
Nose,	*nitu,*	*nyungu.*		
Rain,	*tzi,*			*siu.*
Red,	*ini,*		*bets-ena, serir-ine.*	
River,	*dahoe,*	*nāju.*		
Road,	*diya,*	*nila.*		
Sea,	*dachicu,*		*deche, dechequ-in.*	
Small,	*tua,*		*txoua-pa, T.*	
Star,	*ningutzea,*	*najuiti.*		
Stone,	*noyo,*	*nyugu, noca.*		
Sun,	*sui,*		*chui,*	*sua.*
Teeth,	*niiyu,*	*niji.*		
There,	*hani,*	*ti-ha.*		
Tree,	*iya,*	*nya.*		
Turkey buzzard,	*nikya,*	*nekatu.*		
Water,	*nanda,* (stream)	*nanda.*		
White,	*chuhua,*		*suruna, suat.*	
Wind,	*to,*	*tiho.*		
Woman,	*chu,*		*soora,*	*sue, gŭi.*
Yellow,	*sine,*		*psi, shoin-ore.*	
I,	*gŭá,*	*saho.*		
My,	*na,*	*nba.*		
One,	*gó,*	*ti-ghé, ticaó.*		
Two,	*hó,*	*haó.*		
Three,	*há,*	*haui.*		

I think that the above comparison will leave no doubt but that the Mazatec is affiliated with both these stocks. With regard to

the Chapanecan, no other supposition will explain the substantial identity of the words for:

Fire,	*nii*	and	*nio.*
Water,	*nanda*	and	*nanda* (stream).
Maize,	*nama*	and	*name.*
Tree,	*iya*	and	*nya.*
Lightning,	*kuata*	and	*koita.*
Night,	*nhyu*	and	*nyu-fui.*
Teeth,	*niyu*	and	*niji.*
Stone,	*noyo*	and	*nyugu.*
Cat,	*chito*	and	*txitu.*
Here,	*ihndi*	and	*jande.*
One,	*gó*	and	*ticaó.*
Two,	*hó*	and	*hăó.*
Three,	*há*	and	*háui.*

Not less positive are the identities of the following words of the Mazatecan and Chibchan (Costa Rican) groups:

Sun,	*sui*	with	*chui* or *sua.*
Moon,	*sa*	with	*só, sie* (or *za*).
Ear,	*schical*	with	*quhyca, sehuke.*
Eye,	*schcu*	with	*s'ócvo, ócua.*
Hair,	*coshé*	with	*schá, quyhé.*
Man,	*chi*	with	*he-chi-che.*
Woman,	*chu*	with	*sue, gŭi.*
Rain,	*tzi*	with	*siu.*

[redacted]

But how explain the extensive journey from Nicaragua to the northern limits of the State of Oaxaca? Here an ancient tradition of the Mangues comes to our aid. It was preserved by Father Remesal in his *History of Chiapas*, and runs to the effect that at a remote time a considerable number of the Mangues departed from the shores of Lake Managua and journeyed to the north, into the territory of the Zoques. Remesal construed this to explain the origin of the Chapanecs of Chiapas; but the traditions of the latter do not acknowledge this derivation, and it is probable that the Mangues referred to some other division of their community. This may well have been that which conveyed a mixed dialect of Mangue and Costa Rican as far as the northern borders of Oaxaca.

We have also early evidence that a band of the Mangues, numbering about four hundred souls, occupied a town in the midst of the Costa Rican tribes, in the valley of Guaymi, fronting on the Golfo Dolce. There they were found by the Spanish explorers in 1563.* Doubtless they absorbed more or less of the language of their rulers, the Guaymis; and the following identities between the Mazatecan and the Guaymi vocabularies (published by Mr. Pinart in the *Revue d' Ethnographie*, 1887) seem conclusive.

	Mazatecan.	Guaymi.
Sun,	*sui,*	*shui.*
Moon,	*sa,*	*so.*
Head,	*tku,*	*0okua.*
Nose,	*nito,*	*nido-ñ.*

If these identifications are correct, they enable us to trace the influence of a South American linguistic stock as far into North America as the northern border of Oaxaca—a discovery full of significance for the history of the aboriginal culture of the central portion of the continent.

* Peralta, *Costa Rica, Nicardgua y Panama en el Siglo XVI*, p. 777 (Madrid, 1883).

On the Taxonomy of the Genus Emys, C. Duméril.

By Dr. G. Baur, Clark University, Worcester, Mass.

(*Read before the American Philosophical Society, January 1, 1892.*)

I have just read Prof. L. Vaillant's paper, "Sur la Signification taxinomique du Genre Emys, C. Duméril" ("Ann. Sc. Nat. Zool. et Pal.," viie série, Tome xii, No. 1, Paris, 1891, pp. 51–63). Prof. Vaillant attempts to show that the type of Emys is not *Emys orbicularis* L., as nearly generally admitted lately, but *Testudo picta* Schneider, now generally known under the name of *Chrysemys picta*, and I think he is correct in this. I am, however, unable to follow him in all his other conclusions. I should like to add first, that the name proposed by Brogniart in manuscript, before Duméril had used the French name, les Emydes, in 1804, had been "*Syrinx*." In Isidore Geoffroy-Saint-Hilair's paper on Trionyx, published in 1809, in "Ann. du Mus. d'Hist. Nat., Paris," Vol. xiv, I find the following note on page 3: "On lisoit dans le manuscrit demeuré au secrétariat de l'Institut jusqu'à la publication du volume des Savans étrangers le nom de *syrinx* au lieu de celui d'émyde, mais M. Duméril ayant depuis proposé ce dernier nom, M. Brogniart l'adopta lors de l'impression de son Mémoire."

Besides, I should like to state that the original paper of Brogniart, "Essai d'une classification naturelle des Reptiles," appeared for the first time in 1799, in the "Magazin encyclopédique, ou Journal des Sciences, des Lettres et des Arts," rédigé par A. L. Millin, Vol. vi, pp. 184–201, An. viii, 1799, and was reprinted in the "Bulletin des Sciences, par la Société Philomatique," No. 35, pp. 81, 82, Paris, Pluviose, an 8 de la



Brogniart, who proposed the Latin name "Emydes" in 1805 for Duméril's French name "les Emydes," had given the following species as belonging to it: *E. ferox, E. rostrata, E. matamata, E. lutaria, E. pensylvanica, E. clausa.*

E. ferox and *E. rostrata* belong to *Trionyx* Geoffroy, 1809; *E. matamata* to *Chelus* Duméril, 1806; *Chelys* Oppel, 1811.

It was Merrem * who divided the remaining species of Emys into two groups.†

(*a*) *Emys*—

"Digiti distincti, unguibus acutis.
Rostrum corneum.
Sternum immobile."

* Merrem, Blasius, "Versuch eines Systems der Amphibien," Marburg, 1820, pp. 22, 27. Merrem places the *Testudo lutaria*, with the following synonyms: *Testudo lutaria* L., *T. orbicularis* (*f*) L., *T. europæa* Schneid., *T. caspica* Gmel, among his Emys, not knowing that in this form the anterior part of the plastron is movable.

† I have to say, however, that Rafinesque had already, five years before, reached the same conclusion in a book which is very rare, but of which my friend, Mr. S. Garman, has a copy. I have to thank Mr. Garman for copying for me the part relating to the Testudinata. The title of the book is "Analyse de la Nature ou Tableau de l'Univers et des corps organisés," Palerme, 1815. On page 75 we find:

"*Cryptephia.* Les Cryptephiens.

"Carapace inférieure à 1 ou 2 valves mobiles; enfermant les membres comme dans une boite.

"G. 3. *Cheliphus* R.; 4. *Uronyx* R.; 5. *Didicla* R.; 6. *Monoclida* R.

"*Emydania.* Les Emydiens.

"Carapace ni coriace, ni à valves mobiles, pieds à doigts libres ou palmés.

"G. 7. *Emyda* R., *Emys* Dum.; 8. *Chemelys* R.; 9. *Chelopus* R.; 10. *Chelyda* R., *Chelys* Dum.; 11. *Cheliurus* R."

Unfortunately Rafinesque did not give the names of any species with the new genera, nor did he give any characters. From a later paper, which was written in 1816, but not published before 1832, we receive some information by Rafinesque (Rafinesque, C. F., "Description of Two New Genera of Soft-shell Turtles of North America," *Atlantic Journal and Friend of Knowledge*, Vol. 1, No. 2, Philadelphia, summer of 1832, pp. 64, 65.

"*Cheliphus* Raf. Water turtles with valved shells, 5 claws and toes to all the feet.

"*Uronyx* Raf. An anterior valve to the shell, toes and claws 5 and 4, tail with a claw. *T. scorpioides*, etc.

"*Didicla* Raf. Bivalve lower shell, toes 5 and 4. Type *T. clausa, odorata*, etc.

"*Monoclida* Raf. Lower shell valvular anteriorly, toes 5 and 4. *T. retziana*, etc.

"*Chemelys* Raf. Warty scales, no valves, 4 toes to all the feet. *T. verrucosa*, etc.

"*Chelopus* Raf. No valve, toes not palmated 4 and 5. *T. punctata*, etc.

"*Cheliurus* Raf. No valves, feet palmated, a long scaly tail. *T. serpentina*, etc."

The group with movable valves, named Cryptephia by Rafinesque, contains, therefore, the genera *Sternothærus* = Cheliphus; *Cinosternum* = Uronyx = Monoclida; *Cistudo* = Didicla, part.

The group in which the valves are not movable, named *Emydania* by Rafinesque, contains the genera *Emys* = Emyda; *Clemmys* = Chemelys = Chelopus; *Chelydra* = Cheliurus.

(*b*) *Terrapene*—

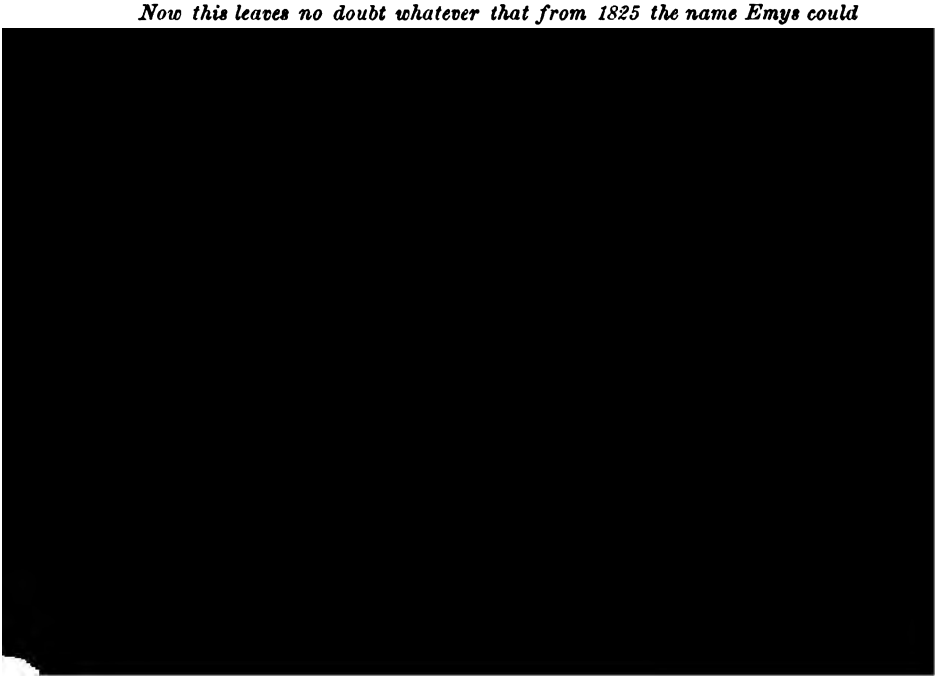
"Digiti distincti, unguibus acutis.
Rostrum corneum.
Sterni lobo anteriore, aut utroque mobili."

Two years later, in 1822, Fleming established the genus *Cistuda* * for the tortoises, in which the entrance to the cavity is formed by a lid. *Cistuda* is simply a synonym of Merrem's *Terrapene*, and has to be abandoned therefore.

In 1825, Gray† follows Merrem, adopting the genera Emys and Terrapene (written Terraphene); "*Cistuda* Say" is declared a synonym of *Terrapene*.

In the same year Bell ‡ published an important paper not mentioned by Prof. Vaillant, in which he shows that *T. europæa* Schneid. (*orbicularis* L.) has to be included in "*Terrapene* Merrem, *Cistuda* Say." He says of *T. orbicularis* L.: "On examining sometime since a shell of this species, the first I had seen, which had lost the sternum, I was struck with the appearance of the articular surface from which that part had been removed, and immediately concluded that it must belong to the present group, having a movable breastplate, notwithstanding Merrem, to whom belongs the credit of having separated the 'Box Tortoises' under his subgeneric division Terrapene, retains this species amongst his Emydes, the character of which, on contradistinction to *Terrapene*, is that the sternum is entire and fixed. On consulting Schöpff, I found that, with his usual accuracy, that author had mentioned the movable structure of the sternum, and subsequent observations have established my first conjecture that it belongs to this genus."

Now this leaves no doubt whatever that from 1825 the name Emys could



In 1828, Ritgen* subdivided the genus *Emys*, in *Emys* and *Clemmys*, and retained *Terrapene* Merrem.

The following species are united with *Clemmys: E punctata, planiceps, glutinata, centrata, subrufa, melanocephala.* Of these *E. punctata* Schöpff = *T. guttata* Schneider, has to be considered as type.

As correctly stated by Prof. Vaillant, *T. picta* Schn. has to be considered as type of Emys, and *Chrysemys* Gray, 1844, becomes therefore a synonym of Emys.

The first author who subdivided the *Terrapene* Merrem, as limited by Bell in 1825, was C. L. Bonaparte,† who separated the American box tortoises under Fleming's name *Cistuda* in 1830 and 1831, from Emys, with *T. orbicularis* as the type.

In 1836, Fitzinger proposed a new name, *Pyxidemys*, to contain the following species: *T. carolina* L. (*T. scheideri* Schweigg., *T. virgulata* Daud.), *Sternothærus trifasciatus* Bell, and *T. amboinensis* Daud. If there would be an objection to the name Cistuda in the sense of Bonaparte, Fitzinger's name *Pyxidemys* ought to be used with the *T. carolina* L. as type. But I think it will be the best to use the name *Cistuda* in the correct form of *Cistudo.*

As a result we have the following:

Emys C. Duméril, s. str.	= Chrysemys (Gray),	Type	*T. picta* Schneider.
Terrapene Merrem	= Emys (Boul.)	"	*T. orbicularis* Lin.
Cistudo Bonap. non Flem.	= Cistudo (Boul.)	"	*T. carolina* Lin.
Cyclemys Bell	= Cyclemys (Boul.)	"	*E. Dhor* Gray.
Clemmys Ritgen	= Clemmys part (Boul.)	"	*T. guttata* Schn.

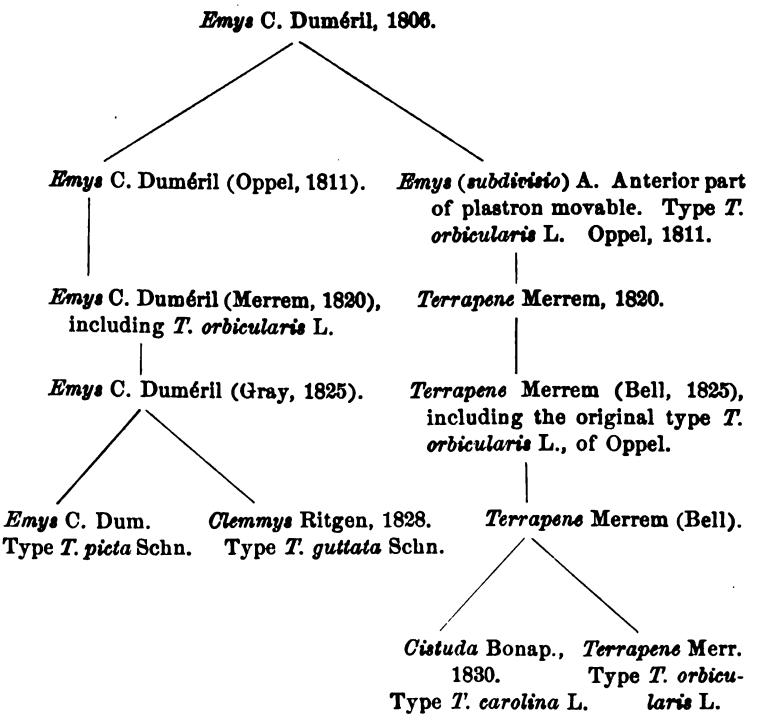
I have shown some time ago that in *Cistudo major* Agassiz, the zygomatic arch is complete (*Science*, April 8, 1891, p. 190), as in *T. amboinensis* Daud., notwithstanding I believe that the Asiatic and American forms are generically separate. I am unable to say whether *T. amboinensis* Daud. belongs to the genus *Cyclemys* Bell, with *E. Dhor* Gray as type, or not. Prof. Vaillant is inclined to place *T. amboinensis* in a genus distinct from *Cyclemys* Bell, for which he uses the name Terrapene. The correct name would be *Cuora* Gray, introduced in 1855.

The whole question relating to the taxonomy of Emys Duméril may be developed in the following table:

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* "Ritgen, F. A., Versuch einer natürlichen Eintheilung der Amphibien," "Nova Acta Nat. Cur.," Vol. xiv, pp. 257–284, Bonn, 1828.

† Bonaparte, C. L., "Osservazioni sulla seconda ediziona del Regno Animale del Barone Cuvier," Bologna, 1830. And "Saggio di una distribuzione metodica degli Animali Vertebrat Giornale Arcadico di Scienze," etc., Roma, Vol. xlix, 1831.


Emys C. Duméril, 1806.
Emys C. Duméril (Oppel, 1811).
Emys (*subdivisio*) A. Anterior part of plastron movable. Type *T. orbicularis* L. Oppel, 1811.
Emys C. Duméril (Merrem, 1820), including *T. orbicularis* L.
Terrapene Merrem, 1820.
Emys C. Duméril (Gray, 1825).
Terrapene Merrem (Bell, 1825), including the original type *T. orbicularis* L., of Oppel.
Emys C. Dum. Type *T. picta* Schn.
Clemmys Ritgen, 1828. Type *T. guttata* Schn.
Terrapene Merrem (Bell).
Cistuda Bonap., 1830. Type *T. carolina* L.
Terrapene Merr. Type *T. orbicularis* L.

Studies in South American Native Languages.

By Daniel G. Brinton, M.D.

(*Read before the American Philosophical Society, February 5, 1892.*)

INTRODUCTORY.

It is not too much to say that the languages of the native tribes of South America are the least known of any on the globe. The problems they present in their grammatical character and affinities remain the furthest from solution, and the materials to undertake such a task are the scantiest from any equal area on the earth's surface. In spite of the labors of such earnest workers as Von den Steinen, Ehrenreich, Adam, Ernst, Darapsky, Middendorff and others, there are numerous tongues of which we know absolutely nothing, or have but bare and imperfect vocabularies.

In the present series of studies I present a variety of material from either unpublished or rare works, accompanied by such suggestions as to its character and relations as have occurred to me in its preparation, and by some observations on the ethnography of the tribes mentioned. As I am convinced that the only ethnographic classification possible of the native tribes of America is that based on language, I do not hesitate to apply this whenever possible.

I.

THE TACANA GROUP.

In my work on *The American Race*,* I offered the following classification of this group:

TACANA LINGUISTIC STOCK.

Araonas,	*Isuiamas,*	*Pukapakaris,*	*Tumupasas,*
Atenes,	*Lecos,*	*Sapiboconas,*	*Tuyumiris.*
Cavinas,	*Maracanis,*	*Tacanas,*	
Equaris,	*Maropas,*	*Toromonas,*	

From this list we must strike out the *Atenes* or *Atenianos* and *Lecos*, as I shall show that these spoke a tongue nowise akin to the

* *The American Race: A Linguistic Classification and Ethnographic Description of the Native Tribes of North and South America.* By Daniel G. Brinton. 1 vol., 8vo, pp. 392 (N. D. C. Hodges, New York, 1891).

Tacana, in spite of some assertions to the contrary by Spanish writers.

Other tribes which should probably be added to this list, as they are located on old maps within Tacana territory and have Tacana names, are:

Carangues, on left bank of Rio Tarabeni.

Chumanos, north of Lake Roguaguado.

Poromonas, on the lower Rio Beni (or Poro).

Samachuanes, on Rio Coroico.

Uchupiamonas, on the Rio Uchupiamona.

Yubamonas, on the Rio Yuba.

The termination *monas* to several of these names is the Spanish plural form of the Tac. *manu*, river, the tribes being named from the streams along which they lived.

In addition to the above I have found that the tribe known as "Guarizas" is to be included among the Tacanas. A series of texts in their language, comprising the Pater, the Ave and the Credo, was found among the papers of Cardinal Mezzofanti, and has been published by Prof. Emilio Teza in his *Saggi inediti di Lingue Americane* (Pisa, 1868). The learned editor states that all his endeavors to identify this language, or to ascertain the location or affinities of the tribe, had been fruitless. A comparison of the Guariza Pater with that in the Tacana, both of which I give on a later page, will prove the very close relationship of the two tribes.

D'Orbigny asserts that "Tacana" is not the name of a tribe



valley of the river Beni (otherwise called the Rio Poro, the Rio Pilcopata and the Rio Madre de Dios), and in the valley of the latter on both banks, between South lat. 12° and 15°. At present the Tacana dialect proper is spoken in the towns of Tumupasa and Isiamas; the Araona by the Araonas, who dwell on the banks of the Beni and on those of its western tributaries, known as the Manuripi, Tahuamanu and Uaicomanu; the Cavineño is confined to the mission of Cavinas; the Maropa to the Maropes, in and near the Pueblo de los Reyes, on the right bank of the Beni, about 12° 30′ S. lat., while the Sapis or Sapiboconas appear to have been the most eastern branch of the stock, as they were attached to the mission of the Moxos in the province of that name on the Rio Mamore.

In 1831 the total number of persons speaking the dialects of this stock was about 6000 (D'Orbigny). The majority of these are nominally Christians and have fixed habitations; but the Toromonas, who dwell between the rivers Madidi and Beni, in 12°–13° South lat., are still uncivilized and heathens; so, also, are the Araonas, who are stated to be cannibals and idol worshipers. Their idols are geometrically shaped pieces of polished wood and stone. Their chief deity is "Baba Buada," whom they identify with the wind, *vutana*, and whose home is in the air. He is said to live towards the south and to be the creator of heaven and earth. The general term for divinity is *edutzi*, and there is a *zia edutzi*, god of maize; an *agave edutzi*, god of health, etc. Each *edutzi* has his own *yanacona*, or priest, to superintend the proper rites.*

Loan Words.

The Tacana-speaking tribes have for generations adjoined on the west the once powerful and cultivated Aymaras, and on the north the populous herds of the Panos. The consequences on their tongue have been quite marked. A number of words have been borrowed from both sources; but they are not so frequent nor of such a character as to authorize the supposition of an original unity with either of the stocks named. I give a list of some of these:

Identities in Aymara and Tacana.

	Aymara.	Tacana.
Arm,	*ampara*,	*embai*, M.
Body,	*amaya*,	*eami*, M.

*E. Heath in *Kansas City Review*, April, 1883; Col. Labré in *Proc. Roy. Geog. Soc.*, 1889; Nic. Armentia, *Explor. del Madre de Dios.*

	Aymara.	Tacana.
Boat,	*kuampu,*	*cuambá,* M.
Cold,	*t'aarata,*	*bruada,* T.
Earth (patria),	*marca,*	*mechí,* S.
Green,	*chojna,*	*china,* T.
Heaven,	*alakhpacha,*	*cacua pacha,* T.
House,	*utax,*	*etei,* M.
Island,	*kuatta,*	*eda-pupu,* T.
Lightning,	*llipikh-llipikh,*	*jüi-jüi,* M.
Man,	*chacha,*	*drejá,* M.
Meat (flesh, body),	*aycha,*	*aicha,* T.
Morning (Span. *mañana*),	*maylla,*	*maita,* M.
Night,	*aruma,*	*apume,* M.
Old,	*achachi,*	*esi,* M.
Star,	*kuara,*	*erujái,* T.

Identities in Pano and Tacana.

	Pano.	Tacana.
Blood,	*imi,*	*ami.*
Child,	*abaque,*	*ebacua.*
Flesh,	*nami,*	*yami.*
Hill,	*matsy,*	*emata.*
Moon,	*bari,*	*bari.*
Small,	*hata,*	*bata.*
Son,	*omibaque,*	*qui embaque.*
Sun,	*uirti* (star),	*ireti.*
Tongue,	*ãna,*	*eana.*
Uncle,	*cucu,*	*cucu, juju.*
Water,	*jena,*	*ena.*

The only two numerals which can be claimed for the Tacana evidently also belong to the Pano:

	Tacana.	Pano.
One,	*pea,*	*atchou-pé, pa-jũ.*
Two,	*beta,*	*ta-bœ, ru-bã.*

The important words for maize, salt, tobacco and banana seem to be borrowed from other tongues:

Maize, *shije* or *dije.*—Probably the Pano *schequi,* which in turn is undoubtedly the Kechua *cherchi,* roasted maize. The grain evidently became known to the Panos as an article of food in this prepared form.

Salt, *banu.*—Apparently a variation of the Arawak *pamu.*

Tobacco, *umaza* or *umarsi.*—Doubtless, from the Tupi *put-uma,* Maypure *iema.*

Banana, *bondare* and *naja*.—The former is the Pano *banara, panala*, and *naja* is the same word with the first syllable omitted ; *banara* is but a corruption of *banana*, an Arawak word.

The color names appear to me irreducible, except that for "green," which has been borrowed from the Aymara.

White,	*pasana.*
Black,	*devena.*
Blue,	*danane.*
Red,	*derena.*
Yellow,	*tidnia.*

A few similarities to the Moseteño, a language spoken by a neighboring stock, may be noted :

	TACANA.	MOSETEÑO.
Fish,	*see,*	*señ.*
Foot,	*cuatsi,*	*yi.*
God,	*edutzi,*	*dogit.*
Water (river),	*ena,*	*ogñi.*
Woman,	*epuna,*	*phen.*

But these have little significance.

PHONETICS.

All the Tacanan dialects are facile and agreeable in their sounds, differing in this respect from the Aymara and Kechua, both of which are harsh to the European ear and almost unpronounceable to a foreigner. The Araona has no sound which is not capable of correct expression by the Spanish alphabet; but the Tacana has the strong English *th* (as in *this*); a soft, scarcely audible aspirate, and a sound intermediate between *t, d* and *r* (heard in *dudu*, brother ; *tata*, father, etc.), while the soft Spanish *th* (as in Span. *ce, ci*) is absent. The *l* is not heard in any native Tacana word.

The statement quoted by D'Orbigny, from a MS. of one of the missionaries, to the effect that the Tacana is one of the most guttural and harshest of languages, is quite incorrect and could not have been intended to apply to any of the dialects of this group.

PRONOUNS.

The paradigms of the Tacana pronouns are as follows :

I,	*ema.*	We,	*ecuana.*
Of me *or* mine,	*quiema.*	Of us, our,	*ecuanasa.*
For me,	*quiemapuji.*	For us,	*ecuana puji.*

To me,	*ema.*	To us,	*ecuana.*
With me,	*ema neje.*	With us,	*ecuana neje.*
Thou,	*miada.*	You,	*micuana.*
Thine,	*miqueda.*	Your,	*micuanasa.*
For thee,	*mique puji.*	For you,	*micuanapuji.*
To thee,	*mida.*	To you,	*micuana.*
With thee,	*mi neje.*	With you,	*micuananeje.*
He or she,	*tueda.*	That,	*ichu.*
Those,	*tueda cuana.*	Those,	*ichu cuana.*
His or her,	*tueda.*	This one,	*jida.*
This,	*yhe.*	These ones,	*jida cuana.*
These,	*yhecuana.*	Who?	*aydeni.*

Verbal Forms.

Of all the dialects the Tacana is richest in verbal forms, and its various subdialects are less variable than its neighbors.

Further, Armentia states that all the dialects have a dual number in both verbs and pronouns, but his work does not furnish the means of analyzing the character of this dual. As is well known to grammarians, there are several very different conceptions of duality in language.

The notion of action in the verbal theme undergoes modification by suffixes, thus:



The termination *ti* appears to be that of the reflexive verb :

dama, to cover.
ja damati, to cover oneself.

The neuter is changed to the active signification by the suffix *me :*

manu, to die.
manuame, to kill.
ja manuamejiji, he who has killed another.

Many verbs are compounded by simple juxtaposition, as :

babe, to know ; *quisa*, to tell ; whence :
babequisa, to teach, *i. e.*, to tell what one knows.

The word *babe*, to know, is itself a derivative from *ba*, to see, which also appears in such compounds as *diaba* (from *dia*, to eat), to eat, seeing, *i. e.*, to test or try a food (*probar la comida*); and *batsuatique* (*tsuati* = above), to look upward.

Literature and Texts.

The literature of the Tacanan dialects—if I may apply this term to such meagre material—is widely scattered and difficult of access. Ludewig, in his *Literature of American Aboriginal Languages* (p. 206), speaks of it as a dialect of the Yurucare, with which it has not the slightest affinity. The same author gives the Sapibocona as a dialect of the Kechua (p. 168), and the Maropa as related to the Yuracare.

Of the Tacana proper I have made use of three published vocabularies: 1. That given by H. A. Weddell, *Voyage dans le Nord de la Bolivie* (Paris, 1859). He gives forty words and six numerals, obtained from a party of Tacanas from Ixiamas and Tumupasa, whom he met at Guanay. 2. A vocabulary of one hundred and fifty-seven words and six numerals, by Dr. E. R. Heath, contributed by him to the *Kansas City Review*, April, 1883. 3. A vocabulary of forty-eight words and ten numerals, accompanied by grammatical observations by the Rev. Nicholas Armentia, published in his *Exploracion del Rio Madre de Dios* (La Paz, 1889).

The only printed text I have found is a small octavo of forty-one pages, with the following title :

" Catecismo | de la | Doctrina Christiana | en Idioma Tacana |

por un Misionero del Colejio de | Propaganda—fide de la | Paz de Ayacucho | 1859. | Imprenta de Vapor.—Calle de la Aduana, No. 36.

The text is entirely in Tacana, without the corresponding Spanish, and embraces the Pater, Credo, Salve, Smaller Catechism, Explanation of the Doctrine, the Via Sacra, etc. I have been unable to discover the author.

Further, Armentia gives also vocabularies of the Araona and Cavineño dialects, and Dr. Heath supplies one of the Maropa. For the Sapibocona, I have relied on that printed by Hervas in his *Vocabulario Poliglotto.*

Dr. Heath refers to the great similarity between the Maropa and Tacana dialects, and adds the remark: "The Maropas have many words that have significations widely different; *etra* means bone and also hair; *biya* means a louse, a wasp and urine." Probably there is a difference in accent or inflection, which is not apparent to the European ear, but which to the native indicates which sense is intended.

The version of the Lord's Prayer given below, as well as that of the Creed, are taken from the *Catecismo en Idioma Tacana*, above referred to. I have added an interlinear translation of the former, and also a translation of the latter, as there is evidently some slight change of the customary phraseology.



Lord's Prayer in Guariza.

Echeza tata evacuepachazu anigi mi, ibbubatagiqicapapuini mige evani, echebe pezu papu eyucaini mi reyno, agigicapapuini mige enime eubbazu evacuepachazu batanja. Ecama geabe chinezu tiage echeza jana pugi: echebe jucha gigicuana ichenubage echeza jucha çetahu, tuevata ecama echeza majaycuana eichenubbaza: ecama tucheme age veca par'ajaja juchazu, chuteme jubua ichenume cuanazu ecama viapenege.

It is evident that this is a version by a different hand into a closely allied dialect.

Creed in Tacana.

I believe in the Father God, of all things in heaven and on earth the maker; I believe in the Lord Jesus Christ, His only Son; who was conceived by the grace of the Holy Spirit, and was born of a virgin; he suffered under the power of Pilate; he was crucified; he died; he went down to limbo; from among the dead he arose on the third day; he went up to heaven; there he is seated on the right hand of the Father almighty; whence he shall come to judge the living and the dead; I believe in the Holy Spirit, the holy Catholic church, the communion of all the saints, the pardon of sins, and that our bodies shall rise again, and that life shall not end.

Eama jei eania tata Dios pamapa aji, evacuapachasu ye eausu seguameji; jei eania tata Jesucristo tusa evacua peada quita; bataji puida Espiritu Santasa gracia eje putzu; etsesa cuara Virgen cuinaida; ichenuda cuana vidinaida Pilatosa emesu; tatajiji puida crususu; dapia manujiji puida, limbosu buteida; manujiji cuana dujusu nettianaida quimicha zinesu; soatida evacuapacha, mesa tata pamapa aji bai eni bene cani, da jenettia epueicha eideni cuana, manujiji cuana equisaba puji; eama jei eania Espiritu Santosa, santa Yglesia catolicasu, santo cuanasa aysaida jacti cuanasa jaditati, jucha cuanasa perdon, ecuanasa equita quita eydeyo pupebæ mave eide cani.

Vocabulary—English-Tacana and Dialects.

T.=Tacana (T. W.=Tacana of Weddell); M.=Maropa; S.=Sapibocona; A.=Araona; C.=Cavineño.

Orthography Spanish; *j*=Eng. *h*; *h* scarcely perceptible; *z*=Eng. *th*.

Alive, *eicle'ja*, T.; *escheveve*, M.
All, *pamapa*, T.; *huana'*, M.
Always, *daja-pincha*, T.
Arm, *ebu'e*, T.; *embai*, M. (probably from *ema*, hand).
Arrow, *pisa*, T.; *pizi*, M.
Ascend, to, *tsuati*, T.
Ashes, *etimu*, T., A.; *etiquimuru*, C.
Aunt, *nene*, T., A., C.
Bad, *mada'da*, T.; *emasa'*, M. (=*ma-saida*, not good).
Bark (of tree), *eviti*, T.; *embiti*, M.
Beard, *que'da*, T.; *eüesa'*, M.
Belly, *etu*, T.; *ese'*, M.; *edde*, T. (W.)

Bird, *dia*, T.; *bu'ni*, M.
Black, *devena*, T.; *sebe'mi*, M.
Blood, *ami*, T. and M.
Blue, *danane*, T.; *savame'*, M.
Body, *equita*, T., C.; *ea'mi*, M.; *ecuicha*, A.
Bone, *e'tro*, T.; *etra'*, M.
Bow, a, *pisatri*, T.; *pisatrue*, M. (see *Arrow*).
Boy, *canane*, *edeave*, T.; *dreja've*, M. (see *Man*); *toro*, A.; *ebacuapi*, C. (see *Child*; *ve* is the diminutive suffix).
Breasts (=mammæ), *atru*, T. and M.
Brother (my elder), *quema-onici*, T.; *be'tri*, M.
Brother (my younger), *quema-cou'*, T.; *chintri*, M.
Brother, *zau*, *uitzecua*, A.; *jau*, *usi*, C.
Canoe, *cua'bua*, T.; *cuamba'*, M., A.; *cuaba*, C. (Aymara).
Charcoal, *etide*, T.; *etesi*, A.; *etirutseve*, C.
Chest, the, *etredu*, T.; *echentru*, M. (breast bone? see *Bone*).
Child, *ebacua*, T.
Cold, *bruada*, T.; *ninna'ma*, M.
Duck, a, *se'e*, T.; *zu'zi*, M.
Ear, *edaja*, T.; *eshacue'na*, M.
Earth (land), *medi*, *edua*, T.; *metri*, M.; *mechi*, C., S.; *eua*, *mesi*, A.
Eat, to, *dia-dia*, T.; *chancha*, M.
Egg, *e'ja*, T. and M.
Evening, *trineti'a*, T.; *trinequa*, M. (see *Day*).
Eye, *etradru'ndru*, T.; *etachundru*, M.; *etuachùru*, S. (see *Sister*, *Elder* and *Hair*; apparently "sister hairs," *i. e.*, eyebrows, eyelashes).
Face, *embu*, T. and M.
Father, my (by son), *rema-tata*, T.; *qui-tata*, M.; *tata*, or *checua*, S. C.
Father, my (by daughter), *rema-tata*, T.; *qui-tata*, M.
Far, *uqueda*, T.; *huazumi*, M.
Feathers, *eina*, T.; *enuqua*, M. (compare *Hair*).
Fingers, *ema*, T.; *emechuja*, M. (=head of hand).
Fire, *qua'ti*, T.; *cua'ti*, M., S., A.; *etiqui*, C.; *otro*, T. (W.) (compare *Ashes* and *Wood*).
Fish, *sisi*, M.; *see*, T.; *jæ*, A.
Flesh (see *Meat*, *Body*).



Good, *saida, saipiave,* T.; *jundra,* M.
Grass, *nutsa,* T.; *ea'ji,* M.
Great, *aida,* T.; *haymi,* M.
Green, *china,* T.; *schepiëi,* M.
Hair, *echu-ena,* T.; *etra,* M.; *echau,* S. (see *Head, Feather, Wing*).
Hand, *e'ma,* T.; *eme,* M., S., A.; *eme-tucu,* C.
He (pron.), *tu-eda,* T.; *tu-ve,* M.
Head, *echu,* T.; *echuja,* M. and S.; *echua,* A.; *iyuca,* C.
Heart, *masu'mo,* T.; *masumu',* M.; *emofobo,* A.; *eniju,* C.
Heaven, *evacuepana,* S.; *evacuapacha,* T.; *buepo,* T. (W.).
Here, *upi'ca,* T.; *iezu',* M.
Hill, a (or mountain), *emata,* T.; *emina,* M. (probably from *ema,* extremity, point, hand).
Hot, *sina'da,* T.; *zintri-trime,* M.
House, *ejtej,* T.; *etai,* M., A.; *etare,* C.
Husband, my, *quemayavi,* T.; *quiave,* M.
I (pron.), *ema* (active form, *ea'ma*), T.; *e'me,* M.
Ice, *ea'na,* T.
Infant, *canane-chidi,* T. (see *Boy*); *ejanana,* M.
Iron, *peama',* M.
Island, *edapu'pu,* T.; *ischa'pupu,* M.
Jar (Sp. *olla*), *jutu,* T., A.; *emaricaca,* C.
Kettle, *co'to,* T.
Kill, to, *manuame, emanuani,* T.; *mane'me,* M.
Knife, *cuchilo,* M. (Spanish).
Know, to, *babe,* T.
Lake, *bai,* T. and M.; *eubihure,* S. (see *Water*).
Laugh, to, *ydeba'ti,* T.; *yaschi-bati,* M.
Leaf, a, *equena',* M.
Learn, *babe tsua,* T.
Leg, *etida'da,* T.; *eta',* M.; *etta,* T. (W.).
Lie, to, *bidumimi,* T.; *ea'na,* M.
Lightning, *tseru-tseru,* T.; *jili-jili,* M.; *ilapa,* S.
Love, to, *esbune'ba,* T.; *imbu-nimbu,* M.
Maize, *dije,* T.; *shije,* M.; *zia,* A.
Make, to (Sp. *hacer*), *ha,* T.
Man, *de'ja,* T., C.; *dreja,* M.; *reanci,* S.; *deja, ecuicha,* A.
Many, *yucua'da,* T.; *dru'je,* M.
Meat, *aicha,* T.; *ea'mi,* M.; *yami,* A.; *erami,* C.
Money, *chipilo,* T.
Moon, *ba'di,* T., A., C.; *tantri',* M.; *bari,* S.
Morning, *matachu,* T.; *mai'ta,* M.
Mother, my (by son or daughter), *quema-qua'ra,* T.; *quicua,* M.; *cua,* S.; *uaua-di,* A.; *cuaha',* C.
Mouth, *aquatri,* T.; *equa'tra,* M.; *ebbo,* T. (W.).
Musquito, *sani* or *di,* T.; *dri,* M.
My, *quema,* T.; *qui,* M.
Name, *ebani,* T.; *embani,* M.
Nails, *ema-tichi,* T.; *eme tichi,* M. (see *Hand*).
Near, *narise,* T.; *drema',* M.
Neck, *eti'pi,* T. and M. and S.
Never, *niquietsunu.*
Night, *liza,* T.; *apume',* M.
No, *ma've,* T. and M.
Nose, *evi-eni,* T.; *evi,* M. and S.
Old, *ecti,* T.; *e'si,* M.
Our, *ecuanasa,* T.
People, *endrani,* T.; *driani qua'na,* M.
Plantain (Sp. *platano*), *nasa,* T.; *naja,* A.; *bondare,* C.
Prairie, *nutsa'ni,* T.
Rain, *nai,* T. and M.
Rattlesnake, *bacua dada,* T.; *sum bacua,* M. (see *Snake*).
Red, *derena,* T.; *utrume,* M.
River, *ena,* T.; *manu,* A.; *exeperearida,* C. (*ena* = water).
Rivulet, *enabaque,* T. (= child-water).

Road, *edidi*, T.; *edisi*, A.; *edigi*, C.
Run, to, *judu'du*, T.; *vandrundu*, M.
Salt, *banu*, T.; *bano*, M.
Say, to, *quisa*, T.
See, to, *ba*, T.; *jam-bati*, M.
Silver, *depe*, T.; *sepe*, A.
Sing, to, *satsu*, T.; *zatru*, M.
Sister, *zatna*, A.; *tatna*, T.; *nasi*, *jane*, C.
Sister, my elder, *quema-du'du*, T.; *drundru*, M.
Sister, my younger, *quematona*, T.; *la'na*, M. (in M. eldest brother says *cani* to his youngest sister).
Sit, to, *aniu'ti*, T.; *animbotia*, M.
Skin, *ebbai*, T. (W.).
Sky, *bueyu'pa*, T.; *embaquapacha'*, M.
Sleep, to, *tabi*, T. and M.
Small, *chicli*, T.; *batavi'chi*, M.
Snake, *bacua*, T. and M.
Son, my (by father or mother), *quema-embami*, T.; *qui-embaqua*, M.; *ena*, A.; *ebacua*, T. C. (see *Child*, *Daughter*).
Soul, *enidu*, T.; *ejiay*, A.; *yata-ecuana*, C.
Speak, to, *mimi*, T. and M.
Squash, *a-jatay*, T.; *jatmi*, M. [illegible] A.; *ena*, C.; *watai*, T. (W.).
Think, to, *piba*, T., A.; *adeba*, C.
This, *yhe*, T.; *iye*, M.
Thorn, *aquida*, T.; *acuisa*, A.; *acuija*, C.
Thou, *mi-cla*, T.; *mi-ve*, M.
Thumb, *ema-chuai*, T.; *eme-chuja*, M. (see *Hand*, *Fingers*, *Head*).
Thunder, *etiria'ni*, T.; *ti'ri*, M.
Tobacco, *umar'si*, T.; *umaza*, M.
To-day, *jeave*, T. and M.
To-morrow, *maita-pûicha*, T.; *bantra*, M. (see *Yesterday*).
Toes, *equatri-ritrana*, T.; *evatri-tichi*, M. (see *Foot* and *Nails*).
Tongue, *eana*, T., M. and S.
Tortoise, *dati*, T.; *dra'ti*, M.
Town, *eju'de*, T.; *ejuntre'*, M.; *erere*, A.; *epu*, C. (see *House*).
Tree, *a'qui*, T. and M.; *acui*, A., C.
Uncle, *juju*, T., A.; *cucu*, C. (a celebrated word, probably of Carib origin, on which Martius founded his classification of the "Guck" nations).
Walk, to, *arease'*, T.; *aze*, M.
Warrior, *jamaji tipuji* (a quarrelsome person), M.
Water, *eavi*, T.; *yu'vi*, M.; *euvi*, S.,

Work, to, *mudumudu*, T.; *mundru*, M.
Ye *or* you, *micuana*, T.; *mica've*, M.
Year, *mara*, S.
Yellow, *tidnia*, T.; *zahuami'*, M.
Yes, *ehe*, T.; *ee*, M.
Yesterday, *maita püicha*, T.; *maita*, M. (see *To-morrow*).
Young, *edea-ve*, T.; *dreja-veve*, M. (= young man).

Numerals.

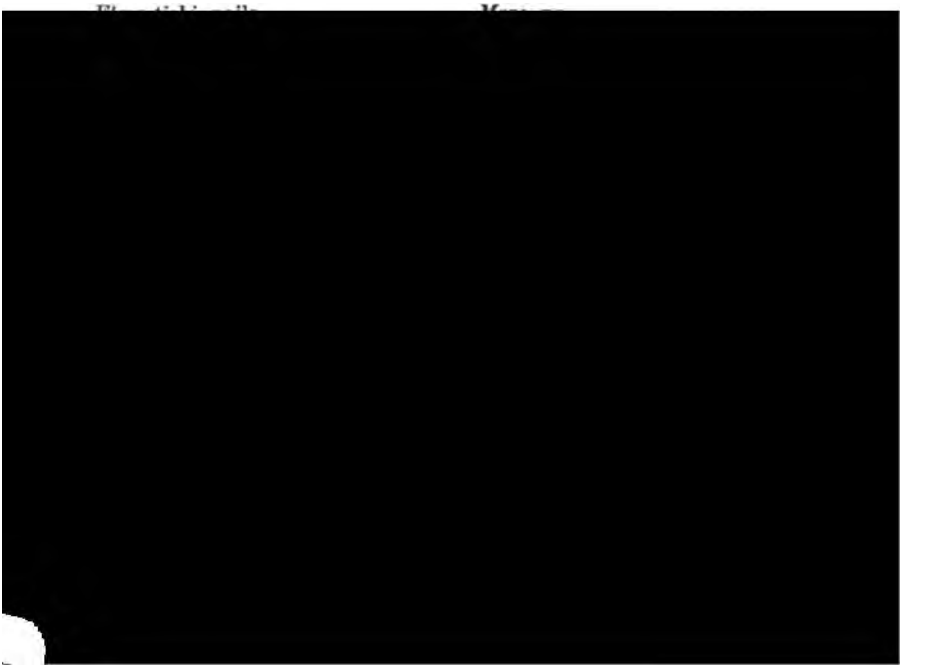
1, *pea, peada, peara*, T.; *pembive*, M.; *pebi*, S.; *equene*, Cat.
2, *beta*, T., M. and S.
3, *quimicha*, T.; *camischa*, M. (Aymara).
4, *pusi*, T. and M. (Aymara).
5, *pichica*, T. and M. (Aymara).
6, *sucuta*, T. and M. (Aymara).
7, *siete*, T. (Spanish).
8, *ocho* (Spanish).
9, *nueve* (Spanish).
10, *tunca*, M. (Aymara); *peara tunca*, T.
20, *beta tunca*, M. (Aymara).

Tacana–English Vocabulary.

Aicha, meat, flesh.
Aida, great.
Ami, blood.
Aniuti, to sit.
A'no, woman, wife.
Apareje, friend.
Aquatri, mouth.
Aqui, tree.
Aquida, thorn.
Arease, to walk.
Atru, mammæ.
Aydeni, who.
Ba, to see.
Babe, to know.
Babe-quisa, to teach.
Babe-tsua, to learn.
Bacua, snake.
Bacua-dada, rattlesnake.
Badi, moon.
Bai, lake.
Banu, salt.
Baque, a deer.
Beni, wind.
Beta, two.
Bruada, cold.
Bueyupa, sky.
Dudu, sister (elder).
Canane, a boy.
Cani, sister (by brother).
Chicli, small.
China, green.
Chipilo, money.
Chupia, there.
Cosi, younger brother.
Coto, kettle.
Cuabua, canoe.
Cuati, fire.
Daja-piucha, always.
Danane, blue.
Dapiave, there.
Dati, tortoise.
Deja, man.
Depe, silver.
Derena, red.
Derena, black.
Dia, bird.
Dia-dia, to eat.
Dije, maize.
Eana, tongue.
Ea'na, ice.

Eari, *water*.
Ebani, name.
Ebbai, skin.
Ebue, arm.
Echu, head.
Echuena, hair.
Ecli, old.
Ecuana, we.
Ecuanasa, our.
Edeave, young.
Edidi, road, path.
Edaja, the ear.
Edapupu, island.
Edeave, a boy.
Edua, earth, land.
Ehe, yes.
Eicleja, alive.
Ei'na, wood.
Eina, feathers.
Eja, an egg.
Ejije, forest.
Ejtej, house.
Ejude, town.
Ema, or *eama*, I.
E'ma, hand, fingers.
E'ma-chuai, thumb.
Emali, forehead.
Emata, hill.

Etiriani, thunder.
Etra driendru, the eye.
Etre, tooth.
Etredu, the chest.
Etro, bone.
Etu, belly.
Etubay, star.
Evacuepacha, heaven.
Evieni, nose.
Eviti, bark of a tree.
Ha, to do, to make.
Idi, to drink.
Ireti, sun.
Jana, food.
Jeave, to-day.
Jenu, squash.
Judu'du, to run.
Juju, uncle.
Jutu, jar.
Liza, night.
Madada, bad.
Mucta puicha, to-morrow or yesterday.
Manu, to die.
Manuame, to kill.
Manujiji, dead.
Masumo, heart.
Matachu, morning.



Piba, to think.
Pichica, five.
Pisa, arrow.
Pisatri, a bow.
Pue, to come.
Pusi, four.
Puti, to go.
Putu, girl.
Quara, mother.
Queda, beard.
Quema, my.
Quietsunu, when.
Quimicha, three.
Quisa, to say, to tell.
Saipiave, good.
Sani, musquito.
Satsu, to sing.
Se'e, a duck.
Sinada, hot.
Sisi, fish.
Sucuta, six.
Tabi, to sleep.
Tata, father.
Tia, to give.
Tidnia, yellow.
Tiri-tiri, to dance.
Tona, sister (younger).
Trine, day.
Trinetia, evening.
Tsada, to wish.
Tseru-tseru, lightning.
Tsi, to steal.
Tsia-tsia, to cry.
Tsuati, to ascend.
Tucheda, strong.
Tu-eda, he.
Tumu, a stone or rock.
Uchi, a dog.
Uitzecua, brother.
Umarsi, tobacco.
Upica, here.
Uqueda, far.
Vere-vere, a fly.
Yavi, husband.
Ychu, that.
Ychucuana, those, they.
Ydebati, to laugh.
Yhe, this.
Yucuada, many.
Zatna, sister.
Zau, brother.

II.

THE JIVARO LANGUAGE.

The material which I have to present on this language is entirely from unpublished sources, and is the more valuable as, so far as I know, not even a vocabulary of this important idiom has ever been printed.

The Jivaros (Givaros, Xivaros, Hibaros, Xeberos, etc.) are a numerous and powerful nation, mostly yet in a savage state, who dwell about the head waters of the rivers Paute, Morona, Santiago and other upper affluents of the Marañon, between 2° and 4° 30′ South latitude, where they occupy the eastern slope of the Cordilleras. I have described their general culture and history in my work on *The American Race*, pp. 282–284.

They are said to present the peculiarity of unusual lightness in color, and features of a decidedly Aryan type.* These traits have

* "Aujour d'hui le type caucasique y domine." says Father Joseph M. Magnin, in *L'Année Dominicaine*, Paris, 1892.

been usually explained by a supposed extensive infusion of Spanish blood when their ancestors captured the city of Logroño in 1599 and carried off the white women as wives. More probably they share, with the Yurucares, Tacanas and other Andean nations, the peculiarity of a complexion several shades lighter than that of the Kechuas and Aymaras.

They have been little influenced by European visitors. A recent authority states that there are scarcely a hundred and fifty Christian families in the whole of the immense province of Canolos, a part of which they inhabit, and the area of which is more than 8000 square leagues.*

The sources which I have had at command are two MSS. in the British Museum, the name of the author not given, but from some remarks probably a German Jesuit, who was a missionary to the tribe towards the close of the last century.

The titles are:

"*Vocabulario en la Lengua Castellana, la del Ynga, y Xebera.*" Small 8vo, fol. 35. The vocabulary embraces about 1300 words, and is apparently complete.

"*Gramatica de la Lengua Xebera.*" Same size. This MS. is imperfect, leaves being lacking both at the beginning and the end.

From these MSS. I have prepared the following sketch of this tongue.

Phonetics.



frequently omitted or uttered so slightly as to be scarcely audible. In the syllables *quec* and *qued* the final consonants are rarely clear, and both often have the sound q'^{r}. In the vocabulary the *õ* and *sch* should be pronounced as in German.

Nouns.

The relations of nouns are indicated by suffixes, *e.g.* :

Tana, the forest.
Tananquec, to the forest, or, in the forest.
Tanancla, from the forest.

Some words indicate the genitive relation by the termination *qui*.

Nouns may be formed from verbals by the suffix *ni* or *bi*, as *timinlec*, I die; *timipi*, the dead person, the corpse; also by the suffix *asu*, as *dacotalec*, I am ashamed; *dacotasu*, one who is ashamed. The infix *cuda* has the same effect.

The instrumental sense is conveyed by the termination *c*, which is the abbreviation of *quec* or *quecla*.

Seotic, knife.
Seotic quec, with a knife.

"With," in the sense of accompaniment, is expressed by *lec*, as:

Sadasulec, with a married man.
Paparulec, with my father.

Direction from is indicated by the termination *quecla*; "for" or "instead of" by *maleg*, as:

Natquimaleg, for or in place of another.

Pronouns.

The personal pronouns are:

I, *coa, qûa.*	We, *cuda, queñmoa, mapoa.*
Thou, *quenma.*	You, *queñma'ma.*
He or she, *nana.*	They, *nauba, nanalosa, nanadap'r-losa.*
This one, *asu.*	Those, *asudap'rlosa.*

The possessives are:

Mine, *quaqui, ru, ca.*	Our, *cudaqui, mapoa.*
Thine, *quenmaqui, palin, ma.*	Your, *quenmamaqui, palenma.*
His, *nanaqui.*	Their, *nanaqui.*

The second forms above given are suffixes or infixes, as:

Sudaru, my husband.
Sudapalin, thy husband.
Loantacasu, my desire.
Loantamasu, thy desire.
Loantasu, his desire.

As usual in American languages, there is no relative pronoun, its place being supplied by participial constructions.

Number and Gender.

Names of inanimate objects usually undergo no change in the plural. For persons the plural is formed by adding the suffix *losa* or *nanlosa*. In possessives the plural suffix is often *na*, as:

Hucha, a sin.
Huchaneng, his sin.
Huchanengna, his sins.

Saden, his wife.
Sadena, his wives.

In verbals and verbs the plural termination may be *dōc*, as:

Huchapidōc, sinnings.

Anulao, leave me.
Anulaodōc, leave us.



Numerals.

The ancient cardinal and ordinal numbers of the Jivaros were as follows:

1, *ala.*
2, *catu.*
3, *cala.*
4, *encatu.*
5, *alacötegladu* (*ala*, one; *ötegla*, hand; *du*, termination).
6, *intimutu* (the thumb, of the second hand).
7, *tannituna* (the index finger, of the second hand).
8, *tannituna cabiasu* (=the finger next the index).
9, *bitin ötegla cabiasu.*
10, *catögladu* (=two hands).

This cumbrous plan has long been superseded by the adoption from the Kechua of the names of numbers above five, so that the present numeration is:

1,	*ala.*	5,	*alacötegladu.*	9,	*iskon.*
2,	*catu.*	6,	*sokta.*	10,	*chunka.*
3,	*cala.*	7,	*ganchis.*	100,	*pazai.*
4,	*encatu.*	8,	*pusac.*		

Particles.

A marked feature of this tongue, which it shares with so many others on the American Continent, is the abounding use of particles to modify the meaning of roots and themes. Whether these are to be regarded as themselves the remnants of worn-down themes, or as primitive phonetic elements, is a yet unsettled question, though for myself I incline to the latter opinion. The MS. I am quoting gives a long list of such significant particles, the most important of which are as follows:

a or *ha* indicates causative action on another; as *uranlec*, I eat; *auranlec*, I cause another to eat.
apa or *pa* denotes present action, as *nambülec*, I live; *nambiapalec*, I am now living.
ata or *anda* is a suffix denoting an interrogation.
cun, as an infix, denotes action about to take place.
ilala, as an infix, signifies that the action is of a permanent character.
imbo, as an infix, conveys a negative sense, and is often employed with the regular negative, *eola.*

itu, inserted before the termination of verbs, indicates that the action is done for another.

la, infixed, signifies that the action is for this one time only.

misan, infixed, conveys the sense that the action is shared by all present.

na, as a suffix, indicates habit, as *intulina*, he who is habitually in a bad temper.

nunda, infixed in the present tense, denotes that the action takes place at some other time; as *notonundalec*, I do it (am accustomed to do it, but am not doing it now).

pa or *mba*, an affirmatory suffix.

qui, as an infix, denotes that the action takes place where the speaker is at the time.

ti is a frequent euphonic suffix, which does not alter the meaning.

van, as suffix or infix, denotes possession; as *huchavanlosa*, those who have sins.

vanan, like *itu*, signifies action for another; as *muchavananamasu*, thou who asks for us.

ya or *nara*, as a prefix, intimates a wish or desire; as *palec*, I see; *yapalec*, I wish to see.

yn, as a prefix, denotes reciprocal or mutual action; as *yainmali*, they desire to take each other (in marriage).

Verbs.

The verbs have but two tenses, the present and the future. Occasionally the adverb *epa*, now, is prefixed to define the present, and *nuca*, pl. *naupa*, to denote a past time.

The formation of the future is frequently irregular, but the



bosucu, I am bad. In a similar sense the verb *nolec* or *nilec*, I do thus, I am thus, is often heard.

There is no trace of a true passive voice, its place being supplied by the sense of the verb or by particles.

At the conclusion of his MS. the author inserts two versions of the Lord's Prayer—the one "in the Xebera language, as it was spoken in the earliest times of the mission," the translation being that of Father Lucas de la Cueva (about 1655); the second in the language of the period of the writer, which I suppose to have been about one hundred and fifty years later.

Of the second or later of these I have ventured an interlinear translation, while the former I insert without a rendering.

Lord's Prayer in Jivaro—Later Version.

Papa mapoa, mosninanloquec napala; linlinpalin nomisansu muchai;
Father our, heaven in art thou; name thy holy become;
quenmaquinlosamasu cudaquec unadiai; loantamasu nomisansu notoi
thy kingdom us to come; desire thy holy be
maponsu mosninanloquec, nanaposu pilaasu lupaquec unda; uglilosa
as heaven in, earth in; daily
tandamapoa epala ugli encaodec; cudaqui huchabidöc anuladöc, maponsu
bread our now to-day give; our sins forgive, as
quenmoa unda alapila dapc'dlosaqui huchanengna anulalidöc; anerata
we others their sins forgive;
quenmoa dentatutan, quenmoa cola Dios ayuaimbocaquec; nanamengtu
our our us
moimbosuöuegla atiegodac.
evil from deliver.

Lord's Prayer in Jivaro—Earlier Version.

Papa mapoa, mosenquec napalac linlinpalin ruchapalin; quenma quilo-samasu cudaquec undiai. Loantacasu notetiuma mapolina mosninanloquec inosupila asumincenloquec unda. Uglilosa tanda epala ugli encaodöc nulaodöc cutaqui hudabidöc; dengquina cuda anulalidöc avbaqui hucha nengna; anerata apolata muchaquec amengdana; moimbocasuquegla atiego.

English-Jivaro Vocabulary.

Above, *mosenquec.*
Ankle, *tula.*
Arm, *da'mpa.*
Arrow, *na'mu.*
Ashamed, to be, *dacetalec.*
Ask, to, *mucha.*
Bad, *moaimbosu, aperosu.*
Beard, *amucuiola noteri,*
Belly, *du', metpi, oquiulec.*
Below, *tilenquec.*

Bird, *ilans'r, tiperllu.*
Black, *catli, cadladasu.*
Blind, *dapina.*
Blood, *uogladec.*
Blue, *carcaso.*
Body, *loqueglo, timipi.*
Bone, *lansi.*
Born, to be, *oclilec.*
Boy, *vila.*
Branch, *taümec.*
Brave, *nan'tapi.*
Breast, *mudin, titoi.*
Brother, *yalli, yuyu'uc.*
Burn, to, *ügedalec.*
Buy, to, *ucolatolec.*
Calabash, *pabi.*
Call, to, *pöclolec.*
Child, *babi.*
Clothing, *capi.*
Come, to, *undialec.*
Cold *no'qûed, noq'r.*
Cotton, *piterlu, boûngpalo.*
Cover, to, *patantulec.*
Dance, to, *danzalec.*
Dawn, to, *ügliti.*
Day, *'ugli.*
Dead, *timiansu.*
Dear, *llada, nünilu.*
Field, *tiq'n ñaua.*
Finish, to, *tavantulec.*
Fire, *poung.*
Fish, *samer, lapisamed.*
Flesh, meat, *canan.*
Flint, *mosed.*
Flute, *pi'leaña.*
Flower, a, *dancu.*
Food, *ca'lo'.*
Foot, *la'ndec.*
Forehead, *teqûeda'.*
Forest, *tana.*
Girl, *vilalu.*
Give, to, *n'galec.*
Go, to, *palec.*
Gold, *uri.*
Good, *môa, moali.*
Grandfather, *papaiangu.*
Grandmother, *ami'.*
Great, *cuni, chi, halupi.*
Green, *canin'rtia.*
Grow, to, *zuzulec.*
Hair, *hintic.*
Hammock, *ta'la.*
Hand, *ötegla.*
Have, to, *nali, napali.*
Head, *uma.*
Hear, to, *la'oclec.*



Last, *na'pi.*
Learn, to, *nintitanalec.*
Life, *nambiacasu.*
Light, a, *ugli, ocli.*
Light a fire, to, *atengtulec.*
Lightning, *yūmerlec.*
Lip, *ū'tec.*
Live, to, *nambilec.*
Lizard, *tuda, lili.*
Love, to, *tan'deñlec.*
Maize, *tōtrn, tōtrlla.*
Man (vir), *queñmopineñ.*
Married man, *sadalec.*
Married woman, *sudalec.*
Medicine man, wizard, *pichotasu muda.*
Monkey, *duda, isolo, lolo.*
Moon, *ducat.*
More, *hapia.*
Most, *halupi, mointi.*
Mother, *auauc.*
Mouth, *lala'.*
Much, *cupi, bapo.*
Name, *linlin* or *lintin.*
Navel, *mumu'la.*
Near, *pa'ula.*
New, *na'lu.*
Night, *dogpili.*
No, *cola.*
Nose, *ne'tic.*
Now, *epald.*
Old, *tas'serpi.*
Old (man), *tas'pitosu.*
Old (woman), *tas'serllu.*
Open, to, *kōquèrlec.*
People, *capomuda.*
Pray, to, *malealec.*
Raft, *sudu'.*
Rain, to, *ōlan, olaali.*
Rainbow, *podo'na.*
Red, *pip'rasu, togua.*
Road, *degaun.*
Root, *ōtecnin.*
Run, to, *tecalec.*
Salt, *lamu'la.*
Say, to, *tulec.*
See, to, *lōlec, lōspalec.*
Semen, *miladöc.*
Send, to, *piuglec.*
Shade, shadow, *dachu'na.*
Sierra, *obituna.*
Sin, a, *hucha.*
Sing, to, *peelalec.*
Silver, *culiqued.*
Sister, *chayauc, cadecuc.*
Sleep, *bitilec.*
Small, *hamecha.*
Smoke, *cadlo* or *callo.*
Snake, *daua.*
Soul, *vada, timipi.*
Spaniard, *vadan.*
Speak, to, *laonlec, lalalec.*
Star, *tandola.*
Stick, *na'la, unguña.*
Strong, *nantapi.*
Sun, *quō'qui.*
Sweet, *yali.*
Take, to, *malec.*
Tame, *daiali.*
Tapir, *pahuala.*
Teach, to, *anintitulec.*
Throat, *unqued.*
Thumb, *intimutu.*
To, *qüec.*
Tobacco, *pinterlo, uhualec.*
Tongue, *ninegla.*
Tooth, *la'tec.*
Totem, clan, *patun.*
Town, *ninan'lo.*
Tree, *nala, squig'uinti.*
Turtle, *mado.*
Uncle, *aprcha.*
Valley, *sa'can.*
Virgin, *inilad.*
Wall, *lupa, patenpi.*
Water, *dōc.*
White, *dadapua'su.*
Who, *deng.*
Wind, *tanlo'a.*
Within, *que'negla.*
Without, *a'dipi.*
Woman, *cunpu, sada.*
Wood, *debbe.*
Yellow, *chapicaso.*

III.

THE CHOLONA LANGUAGE.

Nothing has heretofore been printed of the language of the Cholonas. This tribe dwells on the left bank of the upper Huallaga river, between 8°–9° 30′ South latitude. They were visited by Edward Pœppig in 1829, when he found them to number about 1000 souls, scattered in missions on the banks of the Monzon, Uchiza, Tocache and Pachiza, small streams flowing into the Huallaga. At the close of the last century they occupied a mission with the Hibitos or Xibitos, and together numbered about 5000.* Pœppig asserts that the Hibitos speak a wholly different tongue, but this is denied by my MS. authorities, who acknowledge only a dialectic difference; but the German traveler is correct in his statement that some of the wild Chunchos of the Sierra belong to the same stock.

My source of information in regard to this language is a MS. in the British Museum, entitled *Arte de la Lengua Cholona.* Its author was Fr. Pedro de la Mata, who wrote it in Truxillo in 1748, from which original the MS. in question is a copy made by Fr. Geronimo Clota, in San Buenaventura del Valle, in 1772. It is a small octavo of 132 folios and is complete. Fathers José de Araujo and Francisco Gutierrez wrote also *Artes* of these dialects, but I have not discovered their manuscripts. There is also a MS. *Arte de*



Whether these analogies are sufficient to classify it with the Nu-Arawak groups of Von den Steinen is doubtful. The differences in the personal pronouns especially seem to isolate it from the dialects of that stem.

Phonetics.

The letters *b*, *d*, *r* and *f* are lacking in the Cholona alphabet. The soft *ch* (as in "choose") alternates with the soft *th*; the latter is represented in the Spanish alphabet by *z*, so that in the *Arte*, *z* and *ch* are interchangeable. Initial *g* is hard before all vowels. The vowel represented by *o* is stated to be between *o* and *u*, and is probably the neutral vowel (as *u* in "but"). The initial *i* seems to represent a slight aspiration, as *iayu* or *hayu*, man. The elements *ñ* and *ñg* appear to be nasals.

The accent always falls on the last syllable, except in some verbal forms, where it is found on the penult. Pœppig says that the sound of the spoken tongue is disagreeable to the European ear.

Nouns.

The relations of the nominal theme are indicated by suffixes, which may be arranged to appear like a declension, though not really such.

Nom.—*iayu* or *iayutup*, the man.
Gen.—*iayuilou*, of the man.
Dat.—*iayuhe* or *iayuge*, to the man.
Acc —*iayute* or *iayutu*, the man.
Voc.—*iayuey* or *iayupey* (fem.), O man.
Abl.—*iayute* or *tep*, *pat*, *nic*, with or by the man.

The plural is formed by the insertion of the particle *loi*, before the case ending.

nunlol, the men.
nunlolloula, of the men.
nunlolge, to the men.
nunlolte, the men (accus.).
nunloltep, with or by the men.

The case endings are used only when required to render the meaning clear, as *Juantup Pedro ilami*, Juan killed Pedro, where the accusative termination is omitted, that of the nominative sufficiently indicating the relation. Certain particles also give a plural

sense, in which case *lol* is omitted. These are *mec*, all; *pullem*, along with; *comec*, *incomec* and *pemec*, signifying quantity, and *manmiñ*, as many as. Whenever the plural is indicated by the form of the attached pronoun, other plural signs may be omitted.

There is no grammatical distinction of gender in nouns, difference of sex being indicated by the terms *nun*, male; *ila*, female, which may be either prefixed or suffixed, as:

Man, *nuniayu* or *iayunun*.
Woman, *ilaiayu* or *iayuila*.
Boy, *nunpullup*.
Girl, *ilapullup*.

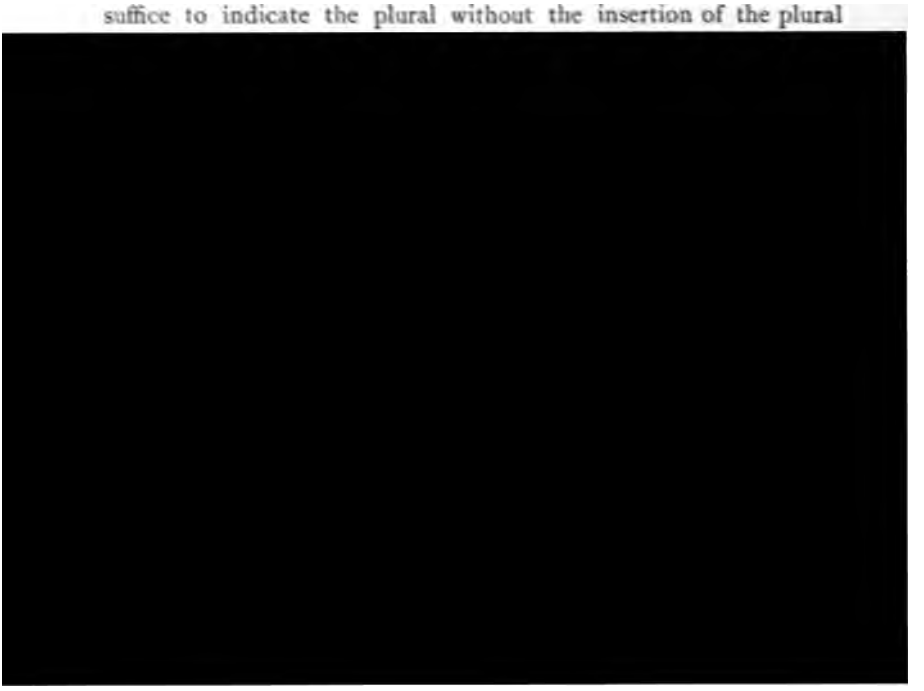
A neuter or epicene gender can be denoted by a suffixed *ô*, as *nunô*, a person.

Various suffixes are added to nouns to modify their meaning, as:

nic, signifying excess or abundance.
zu, signifying absence or negation.
camayoc, indicating knowledge of a subject or practice in it. This word is borrowed from the Kechua.

Pronouns.

The pronouns possess the prominence in this tongue which they so frequently show in American languages. All parts of speech can be grammatically inflected by their agency, and they generally suffice to indicate the plural without the insertion of the plural



In the transitions of verbs the pronouns are abbreviated and certain other forms used, as:

	Singular.		Plural.
1st.	*a.*	1st.	*q, c.*
2d.	*m* (masc.), *p* (fem.).	2d.	*m.*
3d.	*y, c, v.*	3d.	*pa, po, mo, la.*

In adjective nouns the former class are used with euphonic changes, as:

pallou, good, a good thing.
amallou, my good or advantage.
mimallou, thy good or advantage.
quimallou, our good or advantage.
mimallouha, your good or advantage.
chimallou, their good or advantage.
amallouven, it is to my advantage.

The possessives, which form inseparable prefixes to nouns, are united by means of various ellipses and euphonic changes. Example:

Yuca, *el.*

My yuca, *anel.*	Our yuca, *quenel.*
Thy yuca, *menel.*	Your yuca, *menelha.*
His yuca, *nel.*	Their yuca, *enel.*

Numerals.

The numerals are employed with the addition of particles indicating the nature of the objects counted. The most usual of these particles appears to be *zel* or *chil.* The absolute forms, without these suffixes, are as follows:

1,	*an.*	20,	*ip-lec.*
2,	*ip.*	30,	*ix-lec.*
3,	*ix.*	40,	*minip-lec.*
4,	*minip.*	50,	*quioc-lec.*
5,	*quioc.*	60,	*ipzoc-lec.*
6,	*ipzoc.*	70,	*quili-lec.*
7,	*quilip.*	80,	*pac-lec.*
8,	*pac.*	90,	*ocon-lec.*
9,	*ocon.*	100,	*apichac.*
10,	*alec.*		

These offer little resemblance to any other tongue, though the words for 8 and 9 remind one of the Chinchasuyu *pak* and *iskon.*

VERBS.

All active verbs are conjugated by transitions, formed by prefixing the pronoun of the person acting, and inserting immediately after it the pronoun of the person or thing acted upon. Example:

amcollan, I thee love.
mayian, thou me watchest.
payian, he me watches.
asac apuchihan, my food me they give.
misac mapuchilan, thy food thee they give (masc.).
pisac papuchilan, thy food thee they give (fem.).
sac hapuchilan, his food him they give.
ysac apahapuchan, their food them I give.

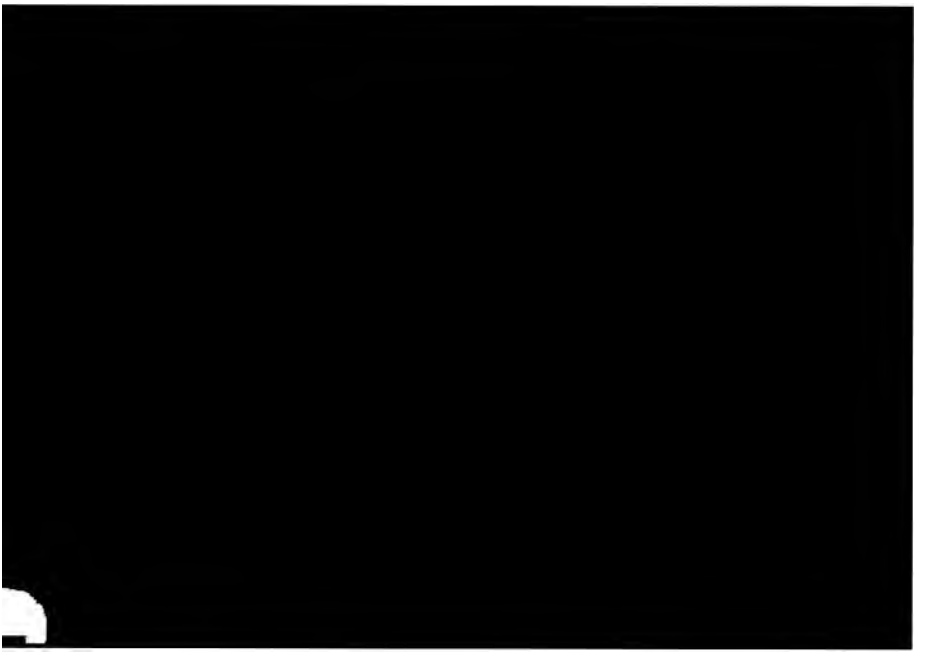
These are forms of the verb *apuchan*, to put before one, a derivative from *amchan*, to put, to place. Other examples:

amcolecte ameñan, I thee wish to love.
micolecte mimenan, thou me wishest to love.
Diosqui ñgolecte quimenan, we wish to love God.
Diostup iccolecte ymeñan, God wishes to love us.

The variation in the third person plural in the transitions appears to depend on the following conditions:

mo is used when the transition is from the third person singular to the third person plural, as in the expression, "he loves them."

po where the transition is from any of the other persons, singular or plural, to the third plural, as:



Syntax.

The construction of phrases will be seen from the following examples:

Liman nê yayu yzip pusimpat añantumilā chectan.
Sierra in men their houses straw with covered are.
"The houses of the Indians in the Sierra are covered with straw."

The noun *zip* and the verb *anantuman* have their pronouns in the third person plural, so the plural particle *lol* is omitted.

The word *chectan* is an abbreviation of *chi actan*, the third person plural of the verb *actan*, I stand, I am in a place. This verb is much used to signify a usual action with reference to a noun, as *cot actan*, I bring water; *zip actan*, I fix or arrange my house; *ayllan actan*, I make the bed, etc.

Ñanmac yayu izipte izon pachacotan.
Each Indian his house in his idols keeps.
"Every Indian keeps idols in his house."

English-Cholona Vocabulary.

Armadillo, *zax, tacla.*
Bad, evil, *iricaj.*
Black, *zaluch* or *chal.*
Boy, *nun-pullup.*
Die, to, *colhac.*
Drink, a, *axillam.*
Drink, to, *axcan.*
Each, every, *ñanmac.*
Eyes, *nache.*
Father, *pa.*
Flesh, body, *aycha* (K.).
Food, *apuchan.*
Fox, *sup.*
Girl, *ña-pullup.*
Give, to, *allan.*
Good, *pullon.*
Green, *lin.*
Hair, *pe.*
Hands, *nen.*
Head, *tech.*
House, *zip, chip.*
Husband, *muluch.*
Idols, *izon, ichoch.*
Lance or dart, *ullue.*
Louse, *cullà.*
Love, to, *agollan.*
my love, *agole.*
my lover, *acoleuch.*
Maize, *cach.*
Man (homo), *iayu* or *hayu.*
(male), *nun.*
(married), *muluch.*
Moon, *pel.*
Mother, *pan.*
Mountain, sierra, *liman.*
Nose, *quexum.*
Not, nothing, *ma.*
Place, to, *amchan.*
Red, *llaca.*
River, *zocot.*
Road, path, *panà.*
Rule, to, *capac* (Kechua).
Sick, *cama.*
Silver, *checho.*
Son, *pul.*
Soul, *zall* or *chall.*
Spittle, *ollè.*
Stars, *kenna.*

Straw, dry grass, *pusim.*
Sun, *muxac.*
Teeth, my, *alè.*
Tongue, *monzey.*
Town, *putam.*
Water, *cot.*
White, *chech.*
Wife, *zala.*
Will, wish, *men.*
my will, *amen.*
I wish, *ameñan.*
Woman (female), *ila.*
ilajayu.
(married), *zala.*
Word, *hil.*
Yuca, *el.*

IV.

THE LECA LANGUAGE.

The Lecos of the river Beni have been erroneously included in the Tacana stock by D'Orbigny and later writers (including myself). The only material I have anywhere found of their language is a short vocabulary given in Weddell's *Voyage dans le Nord de la Bolivia* (Paris, 1859); but this is sufficient not only to take them entirely out of the Tacana group, but probably to place them in an independent position by themselves. As Weddell's book is not to be found in many libraries, I shall translate and rearrange his list of words and precede it with some remarks on the tribe and its possible affinities.

The Lecos are stated by Weddell to have resided originally on the Rio Tipuani and its affluent, the Rio Isuaya, whence they removed to the banks of the Rio Mapiri.



Leca Analogies.

Sun, *he'no;* compare *bue'no* (Opone, Carib stock).
Moon, *kurea;* comp. *kede, siregu* (Carib dialects).
Water, *dua;* perhaps from Carib *tuna.*
Arrow, *uela;* not far from Carib *boule'oua.*
Arm, *bepel;* close to Carib *yapoule, japali.*
Tooth, *bikiri;* nearly the same as the *kxier* and *yeri* of Caribs.
Heaven, *kaut;* almost identical with the Bakairi *kxau* and Carijona *cahoue,* both Carib dialects.
Legs, *boo'te;* comp. Carib *iebeti, beti.*

I think it is safe to infer from the above comparisons that there is an infusion of Carib elements in the tongue; but the material is too scanty to assign its true value.

According to a count made by the missionaries in 1832 there were about two thousand natives at the mission of Aten, all of whom we may assume were Lecos. Dr. Edwin R. Heath, who spent two years in the valley of the Beni about 1880, does not mention them, at least under this name, and gives no specimen of their language.

In personal appearance the Lecos are described (by Weddell) as of pleasant expression, with straight foreheads and horizontal eyes, the mouth of medium size. In temperament they were frank and cheerful. What is unusual, they seemed totally devoid of appreciation or care for music, and had no dances or songs of any kind.

The alphabet of the vocabulary is the Spanish; *ü* is the French *u; j* as *tscha* in German.

English-Leco Vocabulary.

Arm, *bepel.*
Arrow, *uela.*
Belly, *baùahobo.*
Bird, *katchu.*
Blood, *bile.*
Body, *bonotchco'ro.*
Bow, *tchava'ta.*
Child, *yatchpaik.*
Earth, *lal.*
Eyes, *bisiri.*
Feet, *besel.*
Fingers, *biui.*
Fire, *moa.*
Flower, *tutha.*
Forest, *kanda.*
Hand, *bueù.*
Head, *barua.*
Heaven, *kaut.*
House, *uan.*
Leaf, *uoià.*
Legs, *boo'te.*
Man, *yubasa.*
Milk, *buchuluro.*
Moon, *kurea.*
Mountain, *uotha.*
Mouth, *bokòrua.*

Nails (finger), *biuità*.
No, *nai*.
Nose, *bitchinua*.
Rain, *essa*.
River, *dua* (water).
Salt, *tij*.
Skin, *busutche*.
Sun, *he'no'*.
Teeth, *bikiri*.
Tree, *ba'ta*.
Village, *ue's*.
Water, *dua*.
Woman, *tchusuaya*.
Wood, *hamon*.
Yes, *o-o*.

NUMERALS.

1, *ber*.
2, *toi*.
3, *tchai*.
4, *didai*
5, *ber-tcha*.
10, *ber-bivque*.

V.

A TEXT IN THE MANAO DIALECT.

Two hundred years ago the Manaos occupied an extensive tract near where the Rio Negro empties its dark waters into the Amazon. They were, indeed, the most numerous accolents of the Black river on its lower course, and were estimated at something like ten thousand souls. Their large and shapely canoes and plastered conical dwelling houses bespoke a certain advancement in the arts,



Dr. Spix, and published in Martius' *Glossaria Linguarum Brasiliensium;* the other, a short catechetical work, which forms the material of this study, and which has never been printed. The original is in the British Museum, Manuscript Department, and bears the title:

"*Doutrina christa'a pella Lingoa dos Manaos.*"

It has long been known to bibliographers, and is referred to by both Ludewig and Von Martius, but no one has copied or published any portion of it. Its authorship and precise date are unknown, but it has the appearance of a draft or copy of an older work, which it would seem was composed in 1740. The orthography of the Portuguese words is somewhat irregular, and there also seems to be an uncertainty in the spelling of various native terms. The extract which I give is about one-half of the whole, and is sufficient to show the character of the tongue.

A comparison of the words of the text with those collected by Spix about a century later shows little change in the dialect, especially when the difference in the method of transcription is allowed for, the writer of the text having employed the phonetics of the Portuguese tongue, while Spix followed that of the German. To illustrate this, and also to facilitate the examination of the text, I append a list of some of the words in the latter, the majority of which are also found in Spix's vocabulary; the latter I have placed in brackets and appended an S.

English-Manao Words.

All, *sabaque.*
Always, *lyzaôâri.*
Be, to, *sahi.*
Believe, to, *yaniqui.*
Belly, *tuba* (*tula*, S.).
Body, *cacadÿr* (*katy*, S.)
Day, *samaco* (*tzamiko*, S.).
Die, to, *matica* (*uamatika*, S.).
Earth, *etudeo* (*ete'e*, S.).
Father, *yracary* (*apakony*, S.).
God, *Tupa* (*manary*, S.).
Heaven, *quiacucudeo* (*ghinaruigota*, S.).
Hell, *camaa latyma.*
Man, *herenary* (*yrinâly*, S.).
No, not, *mehe* (*me'e*, S.).
Our, us, *ôêne* (*huene*, S.).
See, to, *ôâbata* (*pipata*, S.).
Sins, *barâyda.*
Son, *bauri, dayri* (*tany*, S.).
Stone, *kÿá* (*ghûa*, S.).
Teach, to, *cayna.*
Three, *piaduqui* (*pialuky*, S.).
True, *caura.*
Virgin, *sabyra.*
Where? *padeura.*
Why? *capeda.*

Most of these words are derived from roots extending through

many Arawak dialects, and are the property of that stem. Others, however, are borrowed from the Tupi. This is especially so with the word for God, *Tupa*, which is still in use in the Brazilian "Lingoa Geral."

The personal pronouns as given by Spix are:

I, *no.*	We, *huene.*
Thou, *pi.*	You, *yna.*
He, *erouty.*	They, *nela.*

The possessives, however, which are also employed in the conjugations as inseparable prefixes, differ from these. Thus we have:

õê-mequer, our Lord.
oê-naca, like us.
oâ-yaniqui, we believe.
oâ-batar, we shall see.
p'yaniqùi, thou believest.
bu-batare, they shall see (him).

Doutrina christa'a pella Lingoa dos Manaos.

P. De q'. sorte se ha de haver o homem neste mundo querendosse livarsse do inferno, e querendo hir ao ceo?

R. Crendo em Deos, fasendosse baptizar, i goardando sua ley.

P. Ca peda lyanaqui samaco anaqui çamanna tyma gotia, õáu-ûÿ-ÿápa que rey lÿüá kynaucuda diche lyoáÿá edaca ûẽna?

R. Tupã ÿâquer cayta ca lygara anaquyra.



P. Aonde está Deos?
R. No ceo, e na terra em todo o lugar aonde chamão por elle.
P. Pode o homem ver aqui a Deos?
R. Nam pode ver.
P. Porque?
R. Porque nam tem corpo.
P. Aonde o hemos de ver?
R. No ceo hindo nos la.

P. Os que serem ao Inferno nam o hão de ver?
R. Nam o hão de ver.
P. Por que rezam?
R. Em castigo dessus culpas.

P. Padeura sahi Deos?
R. Quinancudeo, etedeo sabaqui panoquer deo, padeno oâcaÿta.
P. Sabÿra sahi oâbata caÿdêo Tupã?
R. Mehe sabi oâbatar.
P. Caÿpeda?
R. Mehe cacasÿr.
P. Padire öâbatar?
R. Guinacuda dixe guareda öâbatar.
P. Bamane camanhatyma diche gareda babatare?
R. Mehe babatare.
P. Capeda?
R. Mehe baÿaligara gata öéncÿninique.

Preguntas sobre a SS. Trinidade.

P. Quantos Deoses ha?
R. Hum só Deos verdadero.
P. Sendo pessoas quantas são?
R. Sam tres.
P. Como se chamao essas tres pessoas?
R. Deos Padre, Deos filho, Deos Espirito Santo.
P. Aelle se chama santissima Trinidade?
R. Aelle.
P. Porque rezam?
R. Porque em hu so Deos estam tres pessoas.
P. Esse Deos Padre, Deos Filho, Deos Espirito Santo he o mesmo Deos?
R. He hu so e o mesmo Deos.
P. Em quanto pessoas he a mesma pessoas?
R. Nao: em quanto pessoas Deos Padre he differente, Deos filho he differente, Deos Espirito santo he differente.
P. Qual dessas pessoas soffreu

P. Paquiby Tupa?
R. Baúraÿma Tupa caúra.
P. Paquiby lideno paquibÿ.
R. Pyaduqui baduqui.
P. Capacapa mara qui-ÿo piaduqui baduqui-ÿú?
R. Tupan ÿracáry, Tupan baurí, Tupan Espirito Santo.
P. Lysciniqui oena ss. Trind' macúÿ?
R. Lyxiniqui.
P. Capeda?
R. Baûraÿma Tupa lyanaqui pyaduqui baduqui lûrí.
P. Baûrayma lÿari Tupa ly Tupa yracáry Tupa bayrí Tupa Espirito Santo.
R. Baúraÿma Tupa cáry,
P. Baûraÿmara sabi [illegible]
R. Maÿeaí, baurayrnara Tupa yracaí. ÿÿbara Tupa baari lûjaca, Tupa Espirito Santo ÿbara
P. Padeura lya baurayn lya

soy prº, Deos Padre soy prº ou Deos filho ou Deos Espirito Santo?

R. Nao soy prº nen hum todos sempre foram.

P. Qual dessos pessoas antiguamtº foy a q. se fez homem como nos?

R. O mesmo filho de Deos.

P. Como se chama o filho de Deos depoy de feyto homem?

R. Nosso senhor Jesus Christo.

P. Por isso he, que os Christãos tomaram este nome?

R. Por isso.

P. Que quer dizer Christaos?

R. O que he bapti zado, entre em Jesus Christo filho Deos.

P. Deyxou antigamente N. S. Jesus Christo outra pessoa em suo lugar antez de hir ao ceo?

R. Deyxou s. Pedro e todos os Papas seos successores pª governarem a santa madre Igresia Catolica de Roma assim chamada.

P. Que couza he Santa Madre Igresja Catolica de Roma?

R. Sao todos os que sao baptizados e estao pela palavra do summo

Tupa yracary lypa oácaru Tupa bauri oácaru Tupa Espirito Santo?

R. Mehe lyaquyra quariry.

P. Capa bauynâpe qui-yo piaduquy baduqui di lixir; herenari caurarÿ eânady oënâke?

R. Tupan baÿri.

P. Capaçay Tupa bauyri-y herenari caurarÿ tūminhâne garêde?

R. Oëmequer Jesus Christo.

P. Lÿgâÿqui câÿta Chrìstaos?

R. Lÿgâÿqui.

P. Capaçây caytâca Christaosly?

R. Tupan bâÿri catÿâca Jesus Christo eÿáquêr.

P. Nemêda dipa baunâpe õémequer Jesus Christo baura õé cuniapâÿ quinaucuda lixyra gereda f gataÿa?

R. Nemêda S. Pedro sabaque Paÿ abarepano mâr Simani caÿdixi santa madre Igreyja catholica mequêr-ey Papa de Roma õácâÿta.

P. Capacay Santa Madre Igª Catholica de Roma?

R. Sabâque caÿtâca Jesus Christo evaquer ligâra abarepano mar Papa



R. Nen huma pessoa, o fez por graça o por obra do Espirito santo foy feyto.

P. Aonde foy feyto?

R. No ventre de hua donzella chamada Santa Maria.

P. E essa Santa Maria ficou sem lezao assim como otra qualqer virgem que nunca pario?

R. Nem mais nem menos.

P. E depois de parir filou sem lezam?

R. Nao teve lezao ficou sempre virgem.

P. De que sorte se houue N. S. Jesus Christo neste mundo de nascer de sua santissima may?

R. Padeceo fo mecede e canpaço e todos os malles de pena por amor de nos f por nosso amor.

P. Ensinou antigamente N. S. Jesus Christo dando entendimento á gente?

R. Ensinou.

P. Ao depoiz morreo na cruz por nos, em paga de nossos peccados?

R. Morreo.

P. Por amor q.em morreo?

R. Por amor de nos, por amor de nossos peccados, ou satyfuçum delles, plivarnos do Infierno, e levarnos ao ceo.

P. Por sua vontade?

R. Por sua vontade morreo.

P. Pois elle não hera Deos?

R. Hera Deos.

P. Pois esse morreo?

R. Náo: o corpo qtomou de sua santissima may he q morreo.

P. Não havia mos de hir ao ceo, se elle nam morrera?

R. Nao havia mea.

R. Mehe capâtomâr Tupan Espirito santo tuma quenda dêo letuminha f graça tumaquenda dêo letuminha.

P. Padêuora sâhi liâôná?

R. Lÿmâque sabŷra Santa Maria caÿra ababycago erëýma tubadêo.

P. Lydeu-o Santa Maria enidagareda sabyray ababŷ cagoerëyma mehê runida aguŷra sayro?

R. Lÿaquira õárÿ,

P. Lucâõânîquy pura lûy nidan gaıêda?

R. Mehê rupûta.

P. Capêda õémequer Jesus Christo ÿma samâco anaquŷa lÿracâro gatia lÿnidan gaıêda taÿâpa paÿni garêda?

R. Pöátŷ ŷbûri metatŷr pe le ly poŷta sabâque bayque pura ly tá ba ö ã cadŷ che.

P. C aÿna datîr baúÿnapû ö ö mequer Jesus Christo Lita ecatâya nitia herenari ÿchÿ?

R. Recaÿnâda.

P. Guayneŷpa remotîca cruza quadia ö ãmâne baráyda õëneÿ?

R. Matîca.

P. Capeda rematîca?

R. Oágáyque ö á m á n e baráyda õënêÿ camânha tymagatîa o a u güý yápaquer quÿnáudá lixira eda cáydáy.

P. Pananêy?

R. Pananéyra rematica.

P. Mehê saÿhe Tupaly?

R. Tupá.

P. Lydéu-ora Tupá matîca?

R. Mehê; tupá matîca caca rýra liracáro lyxîra ba çua lyõári matîcadý.

P. Mehê ãma quynaucudá diche mehe õ á mátîca garéda?

R. Mehê ãma

P. Quantos dias estenne N. S. Jesus Christo debayxo da terra no teo sepulcro de pedra?

R. Tres dias.

P. Era depois como passou?

R. Resuscitou.

P. Depois de resuscitar como se houve?

R. Subio ao ceo depois de 40 dias.

P. De que sorte se ha, ou esta agourla?

R. Esta asentado à mao direyta de Deos Padre tao honrado e estimado como elle.

P. Paquÿby samâco ŏemequêr Jesus Christo lideo rimaticâni garêda etê üÿn â pudĕo kÿá anaquÿa.

R. Pyaquîbaquî samāco.

P. Guayney padeura?

R. Caydêu-o ocâry.

P. Caydêu-o ocâry guaynèy padêury?

R. Lycuruca iquinaudadire 40 samâco buıûtiquêy.

P. Paquÿpa sahe cachadir lidêury?

R. Tupan yrâcâr sabÿdi libaurây quidêu-o: subinha: aquidi câura ymöèta pyrama.

VI.

THE BONARI DIALECT OF THE CARIB STOCK.

The last of the Bonaris died about 1870. At one time they were a tribe of considerable strength, having their homes in the thick forests along the river Uatumā, which empties into the Amazon from the north, not far below the mouth of the Rio Negro. They were, therefore, neighbors to the Manaos, whose location I have already described.

They were a docile people, and readily collected around the mission Father Nuno Alvarez de Couto established at Sant' Anna

Even a slight examination proves the Bonari a well-marked Carib dialect, and as such it is correctly assigned and located on Karl von den Steinen's linguistic map inserted in his work, *Durch Central Brasilien*. The only word, however, which he gives from their dialect, *keri*, moon, is not quite correct, according to this vocabulary.

ENGLISH-BONARI VOCABULARY.

Air, *cabu*.
Arrow, *purena'*.
Black, *tapaiuna*.
Bow, *urapa'*.
Brother, *mimien*.
Cold, *tecominhoa'*.
Dance, *timiara*.
Ear, *panare'*.
Earth, *nono*.
Eye, *nuruba'*.
Fire, *uatu*.
Fish, *uutu*.
Girl, *meacaba'*.
God, *tupan*.
Grandfather, *tamunbă*.
Head, *iriopo'*.
Heat, *atupeua'*.
Heaven, *maica-paa*.
House, *abeno'*.
Husband, *unhô*.
Infant, *pitianhea*.
Light, *ataquice*.
Man, *uquere'*.
Moon, *quecê*.
Old, *tapoucu'*.
Old woman, *nafoucu'*.
Rain, *cunoba*.
River, *tuna'* (see *Water*).
Son, child, *meco'*.
String, *ubudiana*.
Sun, *usiu'*.
Thunder, *darara'*.
Tooth, *jorê*.
Uncle, *uemi*.
Water, *tuna*.
White, *tiada'*.
Wife, *upuiten*.
Wind, *iriane'*.
Woman, *uauri*.

The influence of the neighboring Tupi tribes is seen in such words as *tupan*, God; *tamunhā*, grandfather; *urapá*, arrow (*urapá'ra*, Tupi); *tiada*, white (*ti*, Tupi); *tapaiuna*, black (*tapanhuna*, Tupi), and a few others more faintly. These are loan-words which do not affect the mass of the language.

VII.

THE HONGOTE LANGUAGE AND THE PATAGONIAN DIALECTS.

Among the manuscripts in the British Museum there is one in Spanish (Add. MSS., No. 17,631), which was obtained in 1848 from the Venezuelan explorer, Michelena y Rojas (author of the *Exploracion del America del Sur*, published in 1867). It contains

several anonymous accounts, by different hands, of a voyage (or voyages) to the east coast of Patagonia, "desde Cabo Blanco hasta las Virgines," one of which is dated December, 1789. Neither the name of the ship nor that of the commander appears.

Among the material are two vocabularies of the Tsoneca or Tehuelhet dialect, comprising about sixty words and ten numerals. These correspond closely with the various other lists of terms collected by travelers. At the close of the MS., however, there is a short vocabulary of an entirely different linguistic stock, without name of collector, date or place, unless the last words, "á la Soleta," refer to some locality. Elsewhere the same numerals are given, and a few words, evidently from some dialect more closely akin to the Tsoneca, and the name *Hongote* is applied to the tongue. This may be a corruption of "Choonke," the name which Ramon Lista and other Spanish writers apply to the Tsoneca (Hongote = Chongote = Choonke = Tsōněca).

The list which I copy below, however, does not seem closely allied to the Tehuelhet nor to any other tongue with which I have compared it.

The MS. is generally legible, though to a few words I have placed an interrogation mark, indicating that the handwriting was uncertain. The sheet contains the following:

DESCRIPCION DEL INDIO.



1,	*pa.*
2,	*sa.*
3,	*chalas.*
4,	*bok.*
5,	*ciechs.*
6,	*tesan.*
7,	*sohs.*
8,	*tachs.*
9,	*teus* (?).
10,	*o'pen.*

No le he podido entender mas.

Canoa,	*tasabay.*
Canalete,	*asaup.*
Toda clase de botones,	*coyocuy.*
Abalorios,	*jamts* (?).

A la Soleta.

The above list I translate and arrange in alphabetical order as follows:

Arms, *cheslan.*
Beads, *jamts* (?).
Belly, *coya'.*
Buttons, *coyocuy.*
Canoe, *tasabay.*
Ears, *coana* (or *coaua*).
Eyebrows, *suman.*
Eyes, *can.*
Fingers, *gaayocoye.*
Foot, *paxaxen.*
Forehead, *eyssen.*
Hands, *cupa'ches.*
Head, *seyocup.*
Knives, *chaxi.*
Leg, *euxin.*
Mouth, *zuxin.*
Neck, *saislan.*
Nose, *bacsen.*
Paddle, *asaup.*
Teeth, *idis.*
Thighs, *cava.*

The other vocabulary, although it presents the same numerals, differs widely in some of the words. It gives:

Fire, *kanikerk.*
Water, *cuk-kin.*
Sun, *kekar.*
Woman, *becok.*
Eyes, *kacuk.*
Ears, *kakuk.*
Mouth, *kakke.*
Tongue, *kakakkët.*

These are more closely akin to other Patagonian dialects than the words of the former vocabulary.

It must be acknowledged, however, that we are but poorly supplied with information about the tongues of Patagonia and Tierra del Fuego. In the latter country we have, indeed, sufficient material in the Yahgan, thanks to Bridges, Adam and others; but in

the Onas tongue there is practically nothing and but little of the Alikuluf.

It is still uncertain whether the last mentioned is a branch of the Yakana-cunny, and whether these latter in turn differ from the true Patagonian or Tehuelhet.*

D'Orbigny insists that the Puelches, who have for a century and a half occupied the plains between the Rio Negro and the Rio Colorado (39° to 41° lat. South), are radically different in language both from their Aucanian neighbors to the north and the Patagonian tribes to the south.† For this reason they are called by the Araucanians *Quimnolu-che*, "People who cannot understand."‡ D'Orbigny's short comparative vocabulary of the "Patagon" and "Puelche" certainly reveals a wide difference, but a comparison of the few words of "southern Puelche" collected by Hale discloses unmistakable identities between the two idioms, as:

	S. PUELCHE.	TEHUEL-HET.
Star,	*sχalela,*	*tsōkalela.*
Tree,	*apa,*	*opuk.*
Bone,	*ohatsk,*	*ohit.*

Mr. Hale collected his vocabularies at Carmen, on the Rio Negro; and the influence of the northern tribes is distinctly visible in them. Especially the Guachi would seem to have percolated into them. The possessive pronoun of the first person singular, *ia* or *ya*, "my," is seen in both Hale's vocabularies and also in D'Orbigny's Puelche. It is common to the Tzoneca or Tehuelhet and



to the Cordilleras.* The words he gives from their tongue—if they can be depended upon—prove it to be an Araucanian dialect.

Of the Chonos, who were a maritime people on the west coast, we have no linguistic material; nor can we define the relationship of the Calen and Taijatef, who resided on the shore south of 48° and spoke one tongue.

In the following table I present a comparison of a limited number of common words in Patagonian vocabularies, beginning with the earliest—that collected by Magellan on his first visit to the straits that bear his name, in 1520. It is interesting to note how little the language has changed in the nearly four centuries which have passed since that period. The list is found in Pigafetta's narration.

Dialect.	Author.	Man.	Woman.	Sun.	Moon.
1. Patagonian,	Pigafetta,			*calezchem,*	
2. "	MS. Br. Mus. I,	*nuken,*	*ache,*	*kora,*	*amania,*
3. "	MS. Br. Mus. II,	*nuken,*	*zunum,*	*koknua,*	*amania,*
4. "	Martius,	*nuken,*	*zunum,*	*shuim,*	*amania,*
5. "	D'Orbigny,	*nuca,*	*nacuna,*	*chuina,*	*chuina,*
6. Tsoneca,	Hale,	*kina,*	*tamo-kanika,*	*apiuχk,*	
7. Choonke or Tehuelche, or	Musters,	*ahonican,*	*karken,*	*gengenko,*	*shoucan,*
8. Tehuelhet,	Lista,			*kenguenkin,*	*shequenon,*
9. Puelche,	Hale,	*kine,*	*tamo-kanok,*	*tçiaχataloka,*	*apiχok,*
10. "	D'Orbigny,	*chia,*	*tam-kal,*	*aplucue,*	*pioo,*
11. Hongote,	MS. Br. Mus I.				
12. "	MS. Br. Mus. II,		*becok,*	*kekar,*	
13. Tekennika (or Yahgan).	Brydges,	*woon,*	*kepa,*	*lum,*	*hannuka,*
14. Alikuluf,		*ackinish.*	*ackhanash.*	*lum.*	*cuun-qua.*

Dialect.	Author.	Fire.	Water.	Head.	Eye.	Ear.
1. Patagonian,	Pigafetta,	*gialeme,*	*holi,*	*her,*	*oter,*	*nink,*
2. "	MS. Br. Mus. I,		*jarra,*	*guil,*	*goerl,*	*jenk,*
3. "	MS. Br. Mus. II,	*hamonaka,*	*karra,*	*guial,*	*gotel,*	*shenk,*
4. "	Martius,	*hamonaka,*	*karra,*	*guil,*	*gettel,*	*shenk,*
5. "	D'Orbigny,	*maja,*	*ara,*	*dil,*	*gutr,*	*jenk,*
6. Tsoneca,	Hale,	*hauakok,*	*iagup,*	*iagoha,*	*iatelk,*	
7. Choonke or Tehuelche, or	Musters,	*yaik,*	*lèy,*	*kittar,*	*ōll,*	
8. Tehuelhet,	Lista,	*yeike,*	*lehe,*		*okel,*	*shan,*
9. Puelche,	Hale,	*auiχok,*	*iagop,*	*ia'or,*	*iatelke,*	*intenk,*
10. "	D'Orbigny,	*aquacake,*	*iagup,*	*iacaa,*	*intiteo,*	*intenzke,*
11. Hongote,	MS. Br. Mus. I.			*seyocup,*	*can,*	*coina,*
12. "	MS. Br. Mus. II,	*kauikok,*	*kukhin,*		*karak,*	*kakuk,*
13. Tekennika (or Yahgan),	Brydges,	*pushaky,*	*shamea.*	*lukahe.*	*della,*	*uffkea,*
14. Alikuluf.		*ittal.*	*chanash.*	*of'chocka.*	*tolkh.*	*tolld.*

*A. Guinnard, *Three Years among the Patagonians*, p. 49 *et al.* (Eng. trans., London, 1871). The prayer he inserts in some dialect not clearly stated on p. 163 is almost pure Araucanian, as are the numerals on p. 261. It is doubtful if he was ever among the true Patagonians (the Tehuelhet).

Dialect.	Author.	Mouth.	Nose.	Tongue.	Tooth.
1. Patagonian,	Pigafetta,	*chian,*	*or,*	*scial,*	*for,*
2. "	MS. Br. Mus. I.			*deol,*	*jor, kor,*
3. "	MS. Br. Mus. II,		*ó,*	*del,*	*kurr,*
4. "	Martius,		*oo,*	*dil,*	*curr,*
5. "	D'Orbigny,	*thum,*	*ho,*		*jor,*
6. Tsoneca,	Hale,	*iapulk,*	*ianots,*		*iaxʷia,*
7. Choonke or Tehuelche, or	Musters,		*tchal,*	*tal,*	*oër,*
8. Tehuelhet,	Lista,	*shahan,*	*or,*		*orre,*
9. Puelche,	Hale,	*iapolk,*	*ianit,*	*iawonōk,*	*ia hai,*
10. "	D'Orbigny,				
11. Hongote,	MS. Br. Mus. I,	*zuzin,*	*bacsen,*		*idis,*
12. "	MS Br. Mus. II,	*kakhe,*		*kakshlut,*	
13. Tekennika (or Yahgan),	Brydges,	*yeak,*	*cushush,*	*lān,*	*tu'un,*
14. Alikuluf.		*uffeare.*	*nohl.*	*luckin.*	*cauwash.*

Dialect.	Author.	Hand.	Foot.	House.	One.
1. Patagonian,	Pigafetta,	*chéné* (*cori*, fingers),			
2. "	MS. Br. Mus. I,	*jan,*	*kel,*	*cocha,*	*jauken,*
3. "	MS. Br. Mus. II,	*ore,*	*kel.*	*cocha,*	*cheuken,*
4. "	Martius,	*ore, fan,*	*keal,*	*cocha,*	*cheuquen,*
5. "	D'Orbigny,	*chémé,*	*ti,*		
6. Tsoneca,	Hale,				*tçic,*
7. Choonke or Tehuelche, or	Musters,	*tsicc'r,*	*shankence,*	*kou,*	*chuche,*
8. Tehuelhet,	Lista,		*alj,*		*choche,*
9. Puelche,	Hale,	*ia sk'vp,*	*iapgit,*	*ahoike,*	*tçi,*
10. "	D'Orbigny,	*ia paye,*			
11. Hongote,	MS. Br. Mus. I,	*cupaches,*	*pasasen,*		*pa,*
12. "	MS. Br. Mus. II,				*pa,*
13. Tekennika (or Yahgan),	Brydges,	*jösch.*	*cōcca,*	*ukkral,*	*ocoale,*
14. Alikuluf.		*yuccaba.*	*cutliculcul,*	*hät.*	*towquidow.*

[redacted]

with a feminine prefix in *iamo-kan-ok*, *kārken*, *ackhanash* (=*wa-kan-ash*). The English form of this root becomes *cunny*, found as a suffix to various tribal names.

Woman.—*Zunum* = woman, as *zunum nakon*, ugly woman; *zunum kekalun*, girl, young woman; *iama* or *yama* means properly "mother;" *ache* or *ysher* (Musters) is a woman of the same gens, the masculine form of which is *chen*, brother; *karken* is a married woman.

Sun and Moon.—The two prevailing roots are *kar* and *shuin*. They both appear in Pigafetta's *calexchem* (=*kare-shuin*). The vocabulary No. 2 translates *kora* as "sun, heaven, God." The generic term for both orbs is *shuin* (*chuina*), which seems allied to the Araucanian *cuyen* of the same meaning. The Hongote *ke-kar* shows the radical *kar*. Another radical for both orbs is the guttural sound variously represented by *kok*, *cuc*, *χok*, *keng*, *geng*, *sheg*. According to Brydges the Yahgans have two different words for sun, *lum* and *usteca*, and two for moon, *annuca* and *hunian*.

Fire.—The radical sound appears to be *'auaχ*, spelled variously *yaik*, *hauak*, *kauik*, etc. The first syllable is visible in *maja* = *ma-yaχ*.

Water.—The term *jarra* or *karra* means "drinking water," from *jara*, to drink; *iagop* is rain water (*ciagop*, rain, Hale); the *léy* and *lehe* of Musters and Lista appear to be an abbreviation of the *ho-li'* of Pigafetta.

Head.—Pigafetta's *her* = *hel*, which is a variant of *guil*, *dil*, etc. Another radical for the idea is a guttural, *'χa*, which is at the base of *ia'oe*, the Hongote *se-yocup*, Yahgan *luka-be*, etc. (comp. Araucanian *lonco*, head).

Eye.—All the words are clearly related except the Hongote.

Ear.—The term given by Pigafetta, *sané*, is repeated with slight variation in the various dialects including the Hongote, except the Puelche, where Hale and D'Orbigny give a different word. The verb *choinqué*, to hear, seems related to *shené*, ear.

Mouth.—Wide discrepancies appear in the terms for this organ. The words *chian*, *shahan* and *ihum* are probably forms of *shum*, which is the right word for mouth, while *ia pelk*, according to Hale, means "my lips."

Nose.—The general root is a modification of *ó*, Lista's *or* = *ob*, which reappears in *tochal*, *nōhl*, etc.

Tongue.—Pigafetta's *scial* reappears in Muster's *tal*, etc.

Tooth.—The prevailing radical *or* may be related to Araucanian *or*, bone.

Hand.—Two conceptions are conveyed by the words presented, *che'mé*, *che'né*, *jan*, *fan*, all forms of the same = upper extremity, arm and hand; while *or*, *cori*, *tsic-c'r*, *ya-s'k'cup* all refer to the fingers.

Foot.—The general root *kel* probably reappears in *'alj*, and even in *shan-kence* (= *chen-kels*, lower extremity), *cutli-kulkul*, etc.

House.—The root is generally *ko'a*.

Numerals.—These display considerable diversity. Several are merely borrowed from the Araucanian, in which we have: 1, *quiñe;* 2, *epu;* 3, *cula;* 4, *meli;* 5, *kechu*. From *kechu*, for instance, comes Hongote *ciech*, Tel. *keitzun*, *tzen*, etc. Hong. *chalas* probably = Tel. *ka-ash;* Hong. *sa* = Tel. *tçi*, etc.

The general conclusion to which these comparisons lead is that the Patagonian dialects are probably more closely related than has hitherto been assumed.

VIII.

THE DIALECTS AND AFFINITIES OF THE KECHUA LANGUAGE.

At the time of the discovery, and probably long before that date, the Kechua language was spoken along and near the Pacific coast from 3° North to 35° South latitude, that is from the Rio



classical, and was adopted by the missionaries as representing the language in its purest and most ancient form. In it the drama of *Ollanta* was composed, which is justly regarded as one of the finest productions of American aboriginal literature.

The identification of the Calchaqui dialect of Tucuman with a patois of the Kechua would settle a vexed question in American ethnography and archæology. The language and the nation of the Calchaquis have long since disappeared; but their material relics, in the shape of well-constructed walls of dressed stones, tombs of the same material, ornaments and images in copper and gold, and handsomely decorated jars of earthenware, still remain in sufficient abundance to testify to a condition of culture among them rivaling that of the Kechuas of the western slope of the Cordilleras.*

The learned traveler, Von Tschudi, imagined that their tongue was the modern Atacameño, and that these sparse inhabitants of the desert were descendants of refugee Calchaquis.† But there is no actual evidence to this effect.

Florentine Ameghino, who has done so much for our knowledge of the Argentine Republic, claims the Calchaqui as a dialect of the Aymara tongue of Bolivia;‡ and the two latest writers on the subject, S. A. Lafone Quevedo and Dr. H. von Ihering, are equally at issue in their opinions. The latter insists that the Calchaquis spoke an idiom wholly different from either Kechua or Aymara;§ while the former argues that this extinct tongue was "not exactly Kechuan, but not altogether distinct" from it, and was a mongrel dialect made up of Kechuan, Abiponian and Guaranian elements.‖

When we turn to the old authorities the point is by no means cleared up. The first and best who states anything definite is the Jesuit missionary, Alonso de Bárzana (sometimes written Barcena), whose letter from "Asuncion del Paraguay," dated September 8, 1594, gives some pertinent particulars. He writes: "The most widely extended languages (in Tucuman) are the Caca, the Tonocote and the Sanavirona. The Caca is spoken by the Diaguitas and throughout the valley of Calchaqui, and that of Catamarca, and in most of the district of Nueva Rioja. Nearly all the towns

* See authorities quoted in my work, *The American Race*, pp. 319 *seq.*

† *Reisen in Süd-Amerika*, Vol. v, p. 84; *Organismus der Khetsua-Sprache*, p. 71.

‡ Ameghino, quoted by Ihering.

§ In *Das Ausland*, 1891, p. 944.

‖ "Notes in the Calchaqui Region," in the *American Anthropologist*, October, 1891, p. 356.

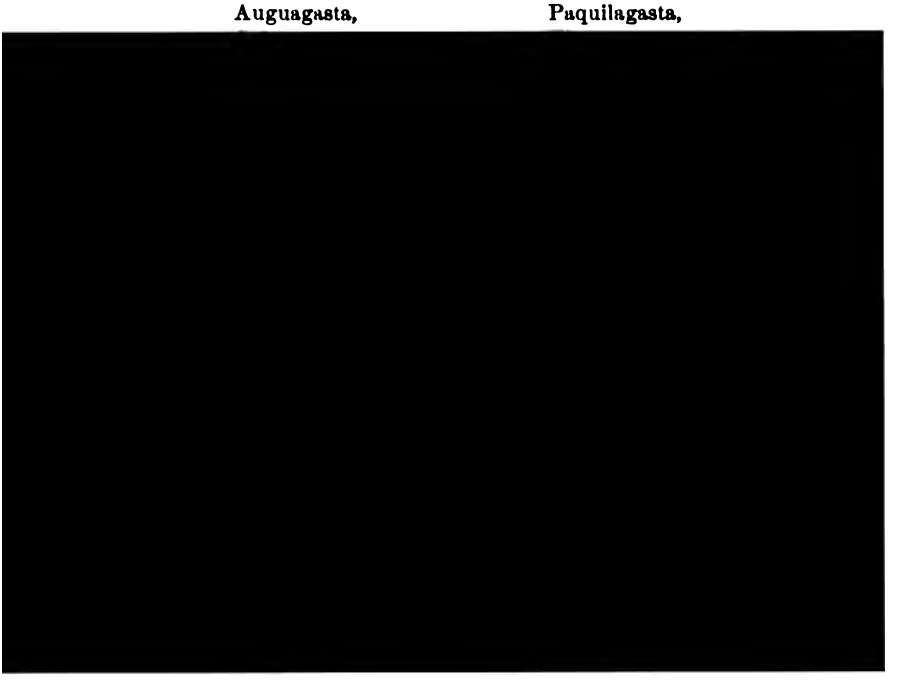
about Santiago use it, as well as the natives along the Rio de Estero, and many more who live in the mountains. I have prepared a grammar and vocabulary of this language."*

These statements assign a distribution of the language over an area about 450 miles from east to west, and 300 miles from north to south. It is highly unlikely that so widespread a tongue should utterly disappear while so many of the descendants of those who spoke it still survive. Yet the native population of Tucuman today speak only a corrupt Kechua dialect, when not Spanish. In fact, the name applied to the tongue by Bárzana, *kaka*, is the Kechua word for mountain, and signifies in this connection the dialect of the mountaineers.

The grammar and vocabulary he prepared are lost, and we have no monuments of the language remaining, except the geographical and other names mentioned in the early writers or preserved on old maps. In examining these one is at once struck with the numerous names of villages ending in *-gasta*. These are found from the Rio Salado to the Cordillera, and from about 26° 30′ to 31° 30′ South latitude; in other words, in just about the area assigned by Bárzana to the Caca tongue.

I quote some of them:

Ambargasta,	Guanagasta,
Amingasta,	Machigasta,
Auguagasta,	Paquilagasta,



Machigasta = *macchiy llacta*, washing town, place where large solid things are washed; quite suitable to the village of the name on the eastern end of Lake Andalgala.

The Kechua origin of these names is plain. But if the Caca or Catamareño, as it is sometimes called, was merely a dialect of the Kechua, why did Bárzana speak of it as a separate tongue? Possibly because the differences in sound were so great as to render it unintelligible to a person familiar only with the dialect of Cuzco.

For the present the evidence seems sufficient to consider the Calchaquis a more or less mixed branch of the Kechua family, and the supposition formerly advanced by myself and others that they constituted an independent stock seems unwarranted.

The Quiteño dialect was held by Von Tschudi to present features of higher antiquity than that of Cuzco. So far as I know, there are few published specimens of it.*

The Chinchasuyu or Chinchaya dialect, also one of the northern branches of the tongue, has been sufficiently analyzed by Von Tschudi in his work on the language, his materials being drawn from the Appendix to the second and third editions of Diego de Torres Rubio's *Arte de la lengua Quechua*, and from the manuscripts of the German engineer, Hermann Göhring.† He finds the pronunciation softer. Certain differences in the verbs appear, in part, to be neologisms. And there is a rather large number of words which are wholly diverse in the two dialects.

The Lamaño is said by Von Tschudi to be closely allied to the Quiteño, but he acknowledges that he was not personally familiar with it.

Whether the Incas, that is, the gens from whom the war and peace chiefs were selected, had a language or dialect peculiar to themselves, as asserted by Garcilasso de la Vega—and by nobody else—has been again brought up for discussion lately by Dr. E. W. Middendorf. He maintains that they had, and that this secret language was the Aymara.‡ This he does in the face of the fact that every one of the eleven words which Garcilasso quotes from this mysterious tongue turns out either to be pure Kechua or from a

* An *Arte*, printed at Lima in 1756, of this dialect, is mentioned by Lodewig, *Lit. of Amer. Aborig. Langs.*, p. 162.

† *Organismus der Kéchua Sprache*, Einleitung, p. 65.

‡ See the Introduction to his work, *Das Runa Simi oder der Kechua-Sprache* (Leipzig, 1890).

Kechua radical.* Dr. Middendorf holds his opinion not so much on the evidence, as to support his favorite theory that the Kechua civilization was derived from the Aymaras and that the Inca gens was of Aymara descent. Unfortunately, he has not acquainted himself with the real constitution of the Kechua social system. It has been ably and satisfactorily analyzed by Dr. Gustav Brühl † and later by Heinrich Cunow.‡

The precise relationship of the Aymara language to the Kechua has received considerable further elucidation through Dr. Middendorf's recent studies. He supplies a list of about five hundred and seventy words, which have approximately the same form and sense in the two tongues, and a second list of about one hundred words which are alike in form but with more or less variation in sense. There is also a strong phonetic likeness between the tongues, and their grammatical characteristics approach each other. His conclusion is that "Aymara and Kechua are sister languages, but are like children of mixed marriages; for while they agree in their essential nature (in ihrem Wesen) quite to the most trivial peculiarities, yet in external grammatical form, as well as in the larger part of their vocabulary, they are wholly asunder." §

This is substantially the conclusion reached by that master of linguistic science, Prof. H. Steinthal, who has ably explained the identities and diversities of these two tongues on principles of the general philosophy of language.||

It is probable that further light would be thrown on this question

Assuming with most Kechuists that the trend of migration was from north to south, we should look towards the north for the oldest forms of the tongue. This, as I have said, Von Tschudi did; but both he and Dr. Middendorf state that they had not seen the work on the Quiteño dialect printed at Lima in 1753, nor apparently any MS. on the structure of the northernmost branches of the tongue.

A vocabulary is mentioned by Von Tschudi, dated in 1814, which gives words of the idiom as spoken in the dioceses of Maynas and Ucayali.

This could be supplemented by a later MS. in my library, containing a *Diccionario castellano-inga* (*y inga-castellano*) *segun se habla en las montañas limitrofes del Ucayali* and a *Gramatica del idioma Inga acomodado al modo de hablar de los manoitas y Maynas*. It is dated 1868, and the author is given as Fr. Mariano Castellanzuelo; but it appears, in part at least, to be founded on some earlier work.

A comparison of this MS. with the grammars of Von Tschudi and Middendorf shows that the dialect of Maynas, the most eastern of all the Kechua dialects, is more closely akin to the Cuzceño than to the Quiteño, both in vocabulary and structure. It does not present the terminal *nga* to the verbal stem, common in the latter. In vocabulary it is nearer the classical Kechua than to the Chinchaya; for example:

	Maynas.	Kechua of Cuzco.	Chinchaya.
Town,	*llacta,*	*llacta,*	*marca.*
Head,	*uma,*	*uma,*	*peka.*
Water,	*yacu,*	*unu,*	*yacu.*
Small,	*uchucela,*	*huchucela,*	*ikchicela.*
Cold,	*chire,*	*chiri,*	*cahcha.*

For the Aymara, the comparison should be made with its purest form. This was confessedly the Pacasa dialect and not the Lupaca, in which the *Arte* and *Diccionario* of Bertonio were composed. At present, although the distinction between the dialects has been in a measure erased by the facilities of modern intercourse, there remain extensive variations both in grammar and vocabulary.* The excellent work of Dr. Middendorf is founded on what purports to be the Pacasa; and in the Brown Library, at Providence, there is a modern folio MS. by D. B. de Merian, entitled *Historia D. N.*

* Dr. E. W. Middendorf, *Die Aymará-Sprache*. Eudeltzsch, Leipzig, 1890.

J. C. in Linguâ Pacasâ. It contains the original and an interlinear translation in Latin. I quote the following passage as an example:

TEXT IN THE PACASA DIALECT OF THE AYMARA LANGUAGE.

Ancha hacha llaquisiñapana kerisiñapa tila humppiñapsa
Summæ afflictionis suæ agone suo, sanguineo sudore suoque finito
tacutatha collna Jesusa cinti carcta uraquetha
divinus Jesus valdé fatigatus de terra surgens,
sartussina yatichatanacparu cutinira.
ad discipulos suos rediit. Verum eos valdé dormientes
Maasca acanaca conti iquisquiri hacjatassina parajtayana
deprehendens, eos excitavit, dicens: "Surgite! Jam enim venit
sassina sartupjama niupilla puri aljirihaja
venditor meus: quomodo vos dormitis? non videtis
lamisaraqui humana cuja iquisipjiquita hanati
quomodo inimicus meus non dormit, sed Judæorum in manus
ulljapjta, camisa aucahaja hanihua iquiti,
suas ad tradendum me jam adest?" Verum, divine Jesus,
maasca Judiona cana amparanacparu catuyaña hattaqui
non solum de discipulis tuis conquerere, de hujus urbis incolis
niahua piori? Maasca collanà Jesusay haniqui
etiam conquerere, qui in omnibus et singulis animas
yatichatanamatha quejasirati aca marca haquenacatha.
suas salvandi rebus semper dormitant, semper otiosi sunt.

(From the *Historia D. N. J. C. in Linguâ Pacasà, diocesis urbis de la Paz. Descripsit D. B. de Merian.* MS. folio.)



Still more recently an effort has been made by Dr. A. Ernst, of Caracas, to establish a linguistic connection between the dialects of the Timote stock, who occupy the Cordillera in the district of Mérida (8° N. lat.), and the Costa Rican dialects, thus bringing the Timotes into the Chibcha stock, as he expressly claims. He goes yet further and seeks to discover verbal identities between the Timote and the Guatuso, spoken in Nicaragua on the Rio Frio. The latter is not supposed to be related to the Costa Rican dialects, which makes Dr. Ernst's theory the more important could it be substantiated. He has published a list of forty-five words in an article in the *Boletin del Ministerio de Obras Públicas* for April 8, 1891 (Caracas, Venezuela), on which he bases his claim. I translate and arrange these words, and shall examine the alleged analogies.

SUPPOSED AFFINITIES BETWEEN TIMOTE, COSTA RICAN AND GUATUSO WORDS.

	TIMOTE STOCK.	COSTA RICAN STOCK.	GUATUSO.
Man,	*caac,*	*caga, caca* (father).	
Woman,	*cursum,*	*ra cur,*	*curiza* (female).
Wife,	*carigura,*		*curijuri* (woman).
Mother,	*shugúe,*		*shu.*
Man, white,	*ticep,*	*suát,*	*otshapa* (señor).
Woman, white,	*ticiura,*	*soóra.*	
Child,	*timúa,*	*istamura* (little).	
Boy,	*sari,*	*hara, tshaasoroj,*	*araptshaura.*
Brother,	*cushis,*	*ayi, tshi.*	
Head,	*kitsham,*	*kotshen* (a point).	
Mouth,	*macabó,*		*macokica.*
Tongue,	*shikicú,*	*kerkuo.*	
Foot,	*cujú,*	*bukurú.*	
Fire,	*shirup,*	*yuc, iyuc, tshicra.*	
Water,	*shimpue,*	*divua* (a torrent).	
Stone,	*tituup,*	*i-úhu-wah,*	*capi* (hard).
Wood,	*tisep,*	*dshi-shiba.*	
Salt,	*shapi,*	*tsheba* (pepper).	
Meat,	*shoroc,*	*susturic* (deer).	
Flesh,			
Skin,	*mishu,*		*maiza.*
Animal,	*ticagüai,*	*oguá.*	
Dog,	*tisirki,*	*shili.*	
Snake,	*sui,*	*shuah.*	
Flea,	*ikis,*	*shiíke.*	

	Timote Stock.	Costa Rican Stock.	Guatuso.
Scorpion,	*ikiyut,*	*ikŭh.*	
Hawk,	*kué,*		*zuë.*
Egg,	*shicapo,*	*cup, icup.*	
Pepper,	*sicas,*	*shiboh, tsheba.*	
Maize,	*shipyac,*	*cupac* (cornfield).	
Bread,	*suridipa,*	*ip* (maize).	
Town,	*musipuc,*	*coc* (place), *susi* (to dwell), *nicona puca* (to live).	
Night,	*kisi,*	*shki.*	
Thief,	*shisnugui,*	*nruoëh.*	
Morning,	*sik,*	*seék.*	
When,	*pena,*		*ping.*
Sweet,	*shiboh,*	*búuk.*	
To go,	*guateque,*	*ta toeh* (I go).	
It rains,	*oki moi,*	*tshoki.*	
One,	*cari,*	*krarâ.*	
Two,	*ca-bó,*	*buúk.*	

On looking over this list it is obvious that the Guatuso affinities are too slight to justify the assumption of a relationship. The syllable *cur* in the words for woman, and *shu* for mother, are the only elements that offer a real similarity, and this is too scanty a supply to work on.

In the Costa Rican analogies the sense is often too remote. It is scarcely fair to consider "father" and "man" as identical ideas; or "child" and "little;" "head" and "point;" "meat"



from Nicaragua, we enter a territory which was at the discovery occupied by nations whose traditions and linguistic affinities pointed to the higher latitudes of North America. Such was the Nahuatl tribe, who occupied the islands and southern shores of Lake Nicaragua, and the Mangues, who peopled the borders of Lake Managua.

The latter were closely related to the Chapanecs of Chiapas, speaking the same tongue with slight dialectic variations. One band of the Mangues, about four hundred in number, was found by the early explorers among the Guaymis, one of the Costa Rican tribes whose language has marked affinities to the Chibcha idioms of New Granada. The close relations thus established between the two stocks reappear in the Mazatec language, spoken in the district of Teutitlan del Camino, State of Oaxaca.

Availing myself of a MS. vocabulary of this language, furnished me by M. A. Pinart, I have shown that it is essentially a Chapanecan dialect, but with a strong infusion of Costa Rican, and especially Guaymi, elements, and presents the most northern example of the influence of South American upon North American languages.* The following examples will illustrate the similarity:

	Mazatec.	Costa Rican.
Sun,	*sui,*	*chui* or *sua.*
Moon,	*sa,*	*só, sie* (or *za*).
Ear,	*schical,*	*quhyca, sehuke.*
Eye,	*schcu,*	*s'ócvo, ócua.*
Hair,	*coshé,*	*schá, quyhé.*
Man,	*chi,*	*he-chi-che.*
Woman,	*chu,*	*sue, gŭi.*
Rain,	*tzi,*	*siu.*
Sea,	*dachicu,*	*dechequ-sn.*
Foot,	*tzoco,*	*tsuku.*
Head,	*tku,*	*θokua.*
Nose,	*nito,*	*nido-ñ.*

The Mazatecs were a people of considerable culture, celebrated for their religious fervor, and for the important temples and sanctuaries established in their country, prominent remains of which still exist.

* See a paper by me in the *Proceedings* of the American Philosophical Society, January, 1892, entitled "The Mazatec Language and its Affinities."

X.

ON THE DIALECTS OF THE BETOYAS AND TUCANOS.

The most recent writer on the Tucanos of the Rio Negro and Upper Amazon, Dr. Franz Pfaff, observes: "Ueber die Stammesverwandtschaft der Tucanos kann mit einiger Sicherheit nichts behauptet werden."* Von Martius believed them a horde of the Tapuya (Gēs, Botocudo) stock;† but their language betrays no such relationship except in a few, doubtless borrowed, words. They are equally far from the great Tupi, Arawack and Carib stocks. But I believe I can show by conclusive evidence that this hitherto unidentified people speak a language akin to that of the Betoyas and Tamas, whose home is located on the eastern slope of the Cordillera, between the head waters of the rivers Apure and Meta.

My further studies of the Betoya dialects have resulted in discovering for them a much wider extension than I assigned in *The American Race*. They can be traced through about ten degrees of latitude (from 3° South latitude northeastward to 7° North latitude) in a large number of tribes resident on the rivers Napo, Putumayo, Caqueta, Uaupes, Negro, Meta and Apure. The affinities of many of these tribes are asserted by the early missionaries, whose testimony on such points was based on a study of the languages. One of the most useful of these sources is the *Noticias Autenticas del Famoso Rio Marañon*, composed by an anonymous Jesuit missionary, and recently published for the first time under



the Napo, and their missions extended north to the banks of the Putumayo, on which stream were the *Amaguages* and the *Ocoguages*. Below the latter, and occupying most of the district between the middle Putumayo on the north and the lower Napo and Amazon on the south, were a number of tribes collectively called *Zeonas* (*Seones*), comprising the *Cungies*, *Parianas*, *Cenceguages* and others. These spoke a tongue allied to that of the Icabuates (Piojes); while "the *Neguas*, *Seizos*, *Tamas*, *Acunejos* and *Atauras* are all of one tongue." The editor, Jimenez de la Espada, speaking from personal knowledge gained on the spot, identifies the modern Piojes with the *Encabellados* of the Spanish writers and the *Icaguates* of the Jesuits.

It is greatly to be regretted that the ample material existing in manuscript for the study of the Zeona language has not been made accessible. Col. Joaquin Acosta had in his library a *Diccionario y Doctrina en lengua Zeona* of 416 pages and another MS. of 116 pages. He expected to present them to the public library of Bogota, but I have not been able to ascertain whether they are there.

From these materials I present the following list of tribes who should be classed in this linguistic family:

The Betoya Linguistic Stock.

Acanejos, a branch of the *Tamas*.
Aguaricos, a branch of the *Tamas*.
Airicos (Ayricos), adjoin *Betoyes* to the south.
Amaguages, on upper Caqueta.
Anibalis, on Rio Apure.
Atuaras, a branch of the *Tamas*.
Avijiras, on Rio Napo.
Becuaries, a branch of the *Icaguates*.
Betoyes, on and near R. Casanare.
Cenceguages, on upper Putumayo south of the *Correguages*.
Ceonas = *Zeonas*.
Cobeus, north of the *Tucanos*.
Correguages, on head waters of Caqueta and Putumayo.
Cungies (Kemgeioios), on R. Cungies, a branch of R. Putumayo.
Curetus (Coretus), west of the *Tucanos*.
Dacé = *Tucanos*.
Eles, north of *Betoyes*, on Rio Casanare.
Encabellados = *Piojes*.
Icahuates (*Icaguates*, *Icaguages*), former name of *Piojes*.
Jamas, on Rio Manacacia.
Jaunas, near River Uauper.

Jupuas, on Rio Apaporis.
Lolacos, a branch of the *Betoyas*.
Macaguages, on Rios Caucaya, Mecaya and Sensella.
Magueias, a branch of the *Icahuates*.
Malifilitos, a branch of the *Betoyas*.
Neguas, a branch of the *Tamas*.
Ocojuages, on R. Putumayo, near R. Pineya.
Pacaries, a branch of the *Zeonas*.
Pizaguas, a branch of the *Icahuates*.
Pequeyas, a branch of the *Piojes*.
Piojes, on Rios Putumayo, Napo and Cocaya.
Pouzevaries, a branch of the *Icahuates*.
Quiiifayes, on Rio Apure.
Seizos, a branch of the *Tamas*.
Seones = *Zeonas*.
Situfas (or *Situjas*), on Rio Casanare.
Tamas, on Rio Yari and R. Cagua.
Tucanos, on the Rio Uaupes.
Uaupes, on R. Uaupes.
Yapuas, a branch of the *Piojes*.
Yehebos, a branch of the *Icahuates*.
Yetes, a branch of the *Piojes*.
Zenseies, a branch of the *Zeonas*.
Zeonas, between lower Napo and Patumayo rivers.

Several of these names are synonyms, or merely the same word with varying orthography. The specific termination of *nomina gentilia* in the Betoya dialects would seem to be *guage*, which is



The Jupua and Curetu dialects are properly one and the same, the difference which appears in their vocabularies arising simply from inequality in the ears and the orthographies of observers. This is evident by the following comparison of the vocabularies of Martius (German orthography) and Wallace (English orthography):

	Jupua (Martius).	Curetu (Wallace).
Blood,	*thik,*	*dū.*
Bow,	*patopai,*	*patueipei.*
Earth,	*thitta,*	*ditta.*
Flesh,	*ga'hi',*	*se'hea'.*
Finger,	*moh-asoing,*	*mu-etshu.*
Fire,	*pieri,*	*piure.*
Flower,	*pagari,*	*bagaria.*
Foot,	*göaphæ,*	*giapa.*
Hair,	*poa,*	*phoa.*
Hand,	*moho,*	*muhu.*
Head,	*co'ëre,*	*cuilri.*
House,	*wu'i,*	*wee.*
Mouth,	*thischüh,*	*dishi.*
Sun,	*hauvä,*	*aoué.*
Tongue,	*toro,*	*dolo.*
Tooth,	*gobäckaa',*	*gophpecuh.*
Water,	*thäco,*	*deco.*
Woman,	*nomöa,*	*nomi.*

These two, the Jupua and Curetu, together with the Jauna and Cobeu, form with the Tucano a group of dialects closely related among themselves; and they are a branch of the same mother tongue as the Betoya, Tama, Pioje and Correguage, which, in turn, present also merely dialectic differences between each other.*

In spite of the imperfect materials yet available to study this extended family, the relationship of its scattered members is demonstrable. To illustrate it, I submit the following:

Comparative Vocabulary of the Betoya and Tucano Dialectic Groups.

Betoya Group: B. = Betoi; C. = Correguage; P. = Pioje; T. = Tama.
Tucano Group: Cob. = Cobeu; Cur. = Curetu; Jup. = Jupua; Tuc. = Tucano.

* Dr. Pfaff (u. s. p. 603) has compared five words of the Tucano, Coretu and Cobeu, presenting similarities; and Dr. Ernst (*Zeitschrift für Ethnol.*, 1891) has shown similarities of six words in Tamas and Tucano; but a general survey of the stock has not heretofore been offered.

Man,	*umasoi*, B. ; *emiud*, C.;	*eum*^{a}, *imea*, Tuc.; *ermeu*, Cob., Cur.
Woman,	*domi*, C.; *romeo*, T.;	*nomi*, Cur.; *nomio*, Tuc.
Fire,	*to'a*, P., T.; *fu-tui*, B.;	*toua*, Cob.
Water,	*oco*, B., C., P., T.;	*oco*, Tuc.; *hóggoa*, Jup.
Rain,	*oco-raime*, C.;	*oco-ro*, Tuc.
Tongue,	*chimenu*, P.;	*chemeno*, Tuc.; *erimendo*, Cob.
Hand,	*r'umocoso* (my hand),	*umoca*, Tuc.
Foot,	*coapi*, C.;	*göaphae*, Jup.; *gɨapa*, Cur.
Teeth,	*cojini*, C.;	*coping*, Cob.
Nose,	*j'inkepiu* (thy), C.;	*enkenha*, Tuc.
Forehead,	*siapue*, C.; *jopue*, T.;	*dipua*, *righpoah* (head), Tuc.
Breast (mamma),	*oχecho*, C.;	*oχ-penno*, Tuc.
Meat,	*guai*, C.;	*ga'hi*, Jup.
Maize,	*huka*, P.;	*o-hoka*, Tuc.
Jaguar,	*ia'i*, P.; *chai*, C.;	*jih*, Jup.
Parrot,	*gueco*, C.;	*weχki*, Tuc.
Deer,	*ñama*, C.;	*ikama*, Jup.
Egg,	*tsia*, C.;	*dia*, Cur.
Fowl,	*cura*, C.;	*caru-hin*, Cob.
Monkey,	*tangue*, C.;	*aχke*, Tuc.
Stone,	*cata*, C.;	*iχtana* (=*i-cata-na*), Tuc.
Star,	*manioco*, C.;	*jocheo'*, Jup.; *ambiocowa*, Cor.; *ua'coa*, Tuc.
Banana,	*ohoh*, P., C.;	*ohoh*, Tuc.
Son,	*sii*, C.;	*si-mugi*, Cur.



The conception of number is very slightly developed in this stock, and even the dialects most closely related show wide variations; for example:

	Betoya.	Tama.	Pioje.
1,	*edoyoyoi*,	*teyo*,	*moño* (finger).
2,	*edoi*,	*ca'yapa*,	*tsamun-cua*.
3,	*ibutu*,	*cho-teyo* (2+1),	*tsamun-huente-cua*.
4,	*ibutu-edoyoyoi* (3+1),	*ca'yapa-ria* (2 again),	*tajeseca*.
5,	*ru-mocoso* (hand),	*cia-jente* (hand),	*teserapin*.

In the vocabularies both *moko* and *jente* (*jete*) are given for hand, and both are used in the words for "five."

In the Tucano group the dialect which has retained the strongest affinities is the Curetu:

	Curetu
One,	*tchudyu* (= Betoya *ĕdyuyu*).
Two,	*ap-adyu* (= " *ĕdyu*).
Three,	*arayu*.
Four,	*apaedyái* (=2+2).
Five,	*tchumupa*.

I believe the evidence here briefly presented will be adequate to prove the extended affinities of this stock, and to vindicate its importance in South American ethnography. How far its analogies may be traced north and west I have not sufficient materials to determine. In *The American Race*, p. 275, I pointed out a few similarities between Betoya and Choco roots; and I would particularly mention that the words for "man" and "woman," *uma* and *ira*, reported by early explorers (in 1515) as in use along the northern shore of Venezuela and the Isthmus of Panama, certainly belong to the Betoya language.*

* "En toda esta tierra llaman à los hombres *omes*, y à las mugeres *iras*." See J. Acosta, *Historia de Nueva Granada*, p. 453. The tract referred to is from the Gulf of Uraba to the Punto del Nombre de Dios, along the shore of the Isthmus of Panama.

Stated Meeting, January 15, 1892.

Present, 47 members.

President, Mr. FRALEY, in the Chair.

Correspondence was submitted as follows:

A circular from the Observatoire National Astronomique et Météorologique d'Athènes, asking exchanges, which was agreed to.

A circular from M. Julio N. Rosas, announcing his appointment as Director Général de Statistique de la Provincia de Buenos Aires, La Plata.

A circular from the Royal Geographical Society, on the orthography of geographical names.

Letters of envoy from the Observatory, Adelaide, S. Australia; Biblioteca N. C. di Firenze; Musée Guimet, Paris; Meteorological Office, Zoölogical Society, London, Eng.

Letters of acknowledgment from the Royal Geographical Society of Australasia, Melbourne, Victoria (131–134); Tokyo Library (135); Prof. Dr. Ludwig Rütimeyer, Basel, Switzerland (135); Direccion General de Estadistica de la Provincia de Buenos Aires, La Plata (131, 132, 133, 134).



Paris; Société de Géographie, Toulouse; Académie N. des Sciences, etc., Bordeaux; Société des Antiquaires de la Morinie, Saint Omer; Zoölogical Society, London; Geological Society, Manchester; Natural History Society, Montreal; Historical and Scientific Society of Manitoba, Winnepeg; Harvard University, Cambridge, Mass.; Travelers' Insurance Co., Hartford, Conn.; Editors of the "American Journal of Science," Agricultural Experiment Station, New Haven, Conn.; Agricultural Experiment Station, Storrs, Conn.; Mathematical Society, New York; Engineers' Club, College of Pharmacy, Franklin Institute, Hydrographic Office, Dr. Charles A. Oliver, Philadelphia; State Board of Health, Nashville; Experiment Station of Florida, Lake City; Editor of "Journal of Comparative Neurology," Cincinnati, O.; Sociedad Cientifica "Antonio Alzate," Mexico.

The decease of the following members was announced:

General Montgomery C. Meigs, Washington, D. C.; born May 3, 1816; died January 2, 1892.

Mr. Addison May, West Chester, Pa.; died January 8, 1892, æt. 80.

Mr. Edward Penington, Philadelphia; died December, 1891.

Prof. Jean Louis Armand de Quatrefages, at Paris, January 12, 1892, æt. 82.

This being the evening for the selection of the Standing Committees of the Society, for the ensuing year, on motion the President was authorized to appoint the same, which he subsequently did as follows:

Finance.

William B. Rogers, Philip C. Garrett, Charles S. Wurts.

Hall.

J. Sergeant Price, William A. Ingham, Charles A. Oliver.

Publication.

Daniel G. Brinton, George H. Horn, Samuel Wagner,
Patterson Du Bois, Horace Jayne.

Library.

Edwin J. Houston, William John Potts, Jesse Y. Burk,
William H. Greene, William S. Baker.

Michaux Legacy.

Thomas Meehan, J. Sergeant Price, William M. Tilghman,
Isaac Burk, Isaac C. Martindale.

Henry M. Phillips' Prize Essay Fund.

Richard Vaux, Henry Phillips, Jr., William V. McKean,
Furman Sheppard, Joseph C. Fraley,
The President and the Treasurer of the Society, *ex officio*.

This being the evening for the election of Librarian, a ballot was held and the tellers reported that Mr. Henry Phillips, Jr., had received 28 votes and Mr. Benjamin Smith Lyman had received 12 votes; whereupon Mr. Phillips was declared duly elected Librarian for the ensuing year.

[Secretary Phillips present and not voting.]

Pending nominations Nos. 1232 and 1235, and new nominations Nos. 1234, 1235, 1236, 1237, 1238, 1239 and 1240 were read.



other members of the Committee, the Chairman stating in answer to inquiry that the signature of the other member was withheld on account of his not approving the second resolution. The resolutions were then read as follows:

Resolved, 1. That the Proceedings of the American Philosophical Society be issued quarterly, and also at more frequent periods whenever an amount of matter is ready for press, which will make sixty-four pages of text, but so as not to interfere with the regularity of the quarterly issue.

Resolved, 2. That in order to permit estimates of the cost of illustrations, authors shall submit either completed drawings or the specimens to be drawn; and that the Secretaries shall accept either as sufficient basis for the publication of articles otherwise unobjectionable.

On motion of Dr. Frazer, the Society proceeded to the consideration of report of the first resolution. A debate took place thereon, participated in by Messrs. Price, Morris, Houston, Cope, Frazer, Barker, Vaux, Martindale and Horn.

Mr. Martindale moved to strike out all after the word "quarterly" and to insert thereafter the words "provided sufficient material shall be furnished for that purpose."

The amendment being put to a vote was carried and a vote being taken on the resolution as amended it was adopted.

The question then arising on the adoption of the second resolution, Dr. Brinton stated his reasons for declining to recommend the same, and offered as an amendment the substitution of the word "may" for "shall" in the third line, to read "the Secretaries may, etc."

The amendment was carried and the resolution as amended was adopted.

On motion of Mr. Dudley, the Society adjourned.

Stated Meeting, February 5, 1892.

Present, 8 members.

Dr. MORRIS in the Chair.

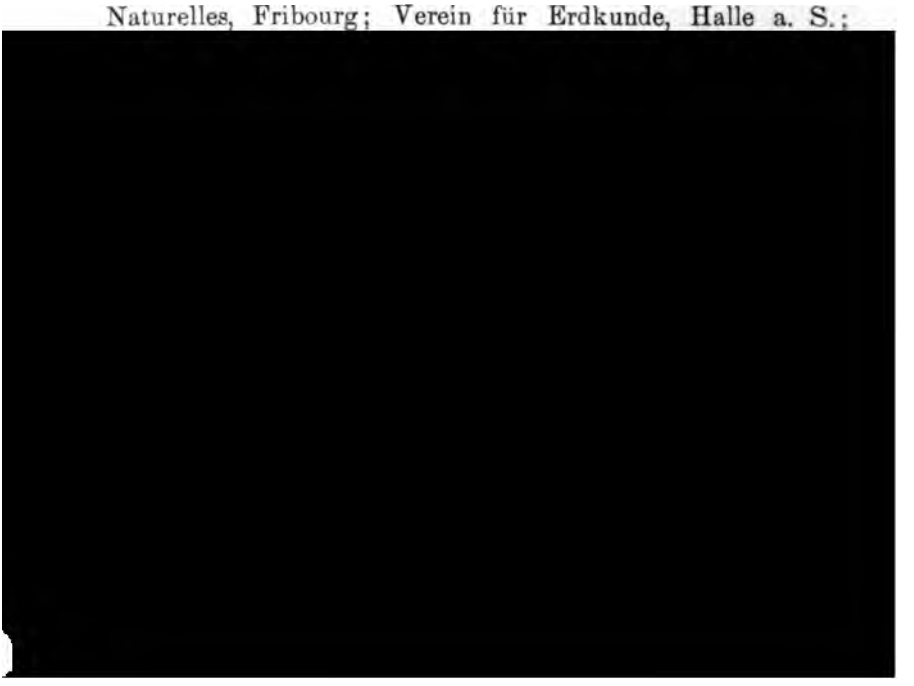
The following correspondence was submitted:

A letter from Commander F. M. Green, U. S. A., giving sufficient reasons for declining the membership in the Society to which he had been elected.

A circular from the Manchester Geographical Society, announcing the decease of its President, the Duke of Devonshire.

A letter from Gustav Fock, bookseller in Leipzig, offering for sale the library of the late Prof. Zarnke for 45,000 marks.

Accessions to the Library were announced from the Royal Society of South Australia, Prof. H. Y. L. Brown, Adelaide; Linnean Society of N. S. Wales, Sydney; Prof. H. H. Risley, Calcutta; Section für Naturkunde O. T. C., Vienna; K. danske Geografiske Selskab, Copenhagen; Gesellschaft für Erdkunde, Deutsche Geologische Gesellschaft, Horticultur-Gesellschaft, Messrs. Friedländer & Sons, Berlin; K. Sächsische Meteorologische Institut, Chemnitz; Société des Sciences Naturelles, Fribourg; Verein für Erdkunde, Halle a. S.;



Hon. Robert C. Winthrop, Prof. Eben Norton Horsford, Harvard University, Cambridge; Essex Institute, Salem; Brown University, Providence, R. I.; Prof. E. North, Clinton, N. Y.; Free Public Library, Jersey City; Bureau of Statistics of New Jersey, Trenton; American Pharmaceutical Association, Drexel Institute, Drs. J. E. Ives, D. Jayne, J. C. Ayer, Mr. Henry Phillips, Jr., Philadelphia; American Chemical Society, Baltimore; Anthropological Society, Bureau of Navigation, Mr. Lester F. Ward, Washington, D. C.; Oberlin College, Oberlin, O.; Colorado Scientific Society, Denver; Observatoire Météorologique Central, Observatorio Astronómico Nacional de Tacubaya, Mexico; Observatorio Nacional Argentino, Buenos Aires; Museo de La Plata; Prof. Ladisláu Netto, Rio de Janeiro.

The Committee on Dr. Cope's Paper for the Transactions reported the same to be worthy of publication and was discharged.

Photographs of the following members were presented for the Society's Album:

Dr. Thomas Chase, Providence, R. I.

Dr. J. L. Campbell, Crawfordsville, Ind.

Dr. W. G. A. Bonwill, Philadelphia.

Mr. Charles Truscott presented a photograph from the portrait of Franklin owned by the Society.

Miss Emily Phillips presented a locket containing hair of General Andrew Jackson.

The following announcements of the deaths of members were made:

Paul Hunfalvy, Budapesth, December, 1891.

Andrew C. Ramsay, London, December, 1891.

Thomas Jefferson Lee, Baltimore, December, 1891.

Rev. Joseph F. Garrison, Camden, N. J., January, 1892, æt. 70.

The President appointed Mr. William John Potts to prepare the obituary notice of Dr. Garrison.

Prof. Cope offered for the Transactions a paper by himself on "The Homologies of the Posterior Cranial Arches in the

Reptilia," which was referred to a Committee to be appointed by the President.*

Dr. Cope offered for the Proceedings "A Contribution to the Vertebrate Palæontology of Texas."

Dr. Brinton presented for the Proceedings "Studies in the South American Native Languages," which was ordered to be printed.

The paper by Dr. Bonwill, "Geometry and Mechanics Deny Evolution," was made the special order for March 4, 1892.

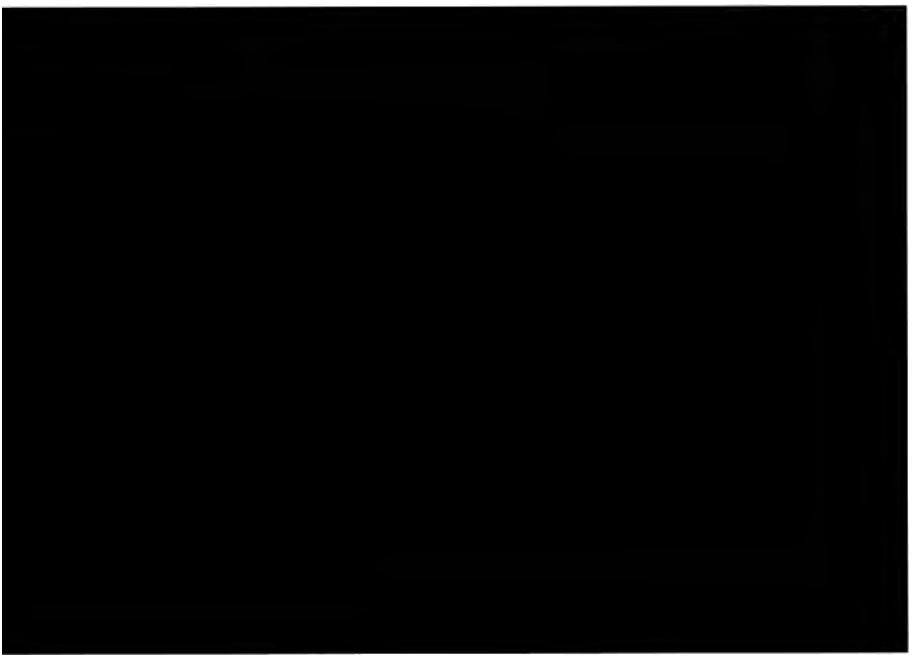
Pending nominations 1232 to 1240 (inclusive) were read.

On motion of Dr. Brinton, it was resolved that a Committee of three should be appointed by the President to consider the advisability of taking concerted action in connection with other learned societies for the celebration of the four-hundredth anniversary of the discovery of America. †

And the Society was adjourned.

Stated Meeting, February 19, 1892.

Present, 12 members.



Museum of Comparative Zoölogy, Profs. A. Agassiz, Charles W. Eliot, Robert N. Toppan, Cambridge, Mass.; Dr. Pliny Earle, Northampton, Mass.; Essex Institute, Salem; American Antiquarian Society, Worcester; Brown University, R. I. Historical Society, Providence; Mr. George F. Dunning, Farmington, Conn.; Historical Society, Theological Seminary, Hartford; Yale University, N. H. Colony Historical Society, Profs. O. C. Marsh, H. A. Newton, W. D. Whitney, New Haven; Prof. James Hall, Albany; Society of Natural Sciences, Buffalo Library, Buffalo, N. Y.; Prof. E. North, Clinton, N. Y.; Profs. J. M. Hart, J. E. Oliver, Ithaca, N. Y.; American Museum of Natural History, Mathematical Society, Meteorological Observatory, New York Historical Society, Hospital Library, University of the City of New York, General Henry L. Abbot, Mr. Joel A. Allen, Prof. J. J. Stevenson, New York; Vassar Brothers Institute, Poughkeepsie; Oneida Historical Society, Utica; U. S. Military Academy, West Point; Prof. Henry M. Baird, Yonkers; Mr. Isaac C. Martindale, Camden, N. J.; Profs. W. H. Green, C. A. Young, Princeton; Dr. Robert H. Allison, Ardmore, Pa.; Mr. Burnet Landreth, Bristol; Prof. Robert W. Rogers, Carlisle; Prof. Martin H. Boyé, Coopersburg; Hon. Eckley B. Coxe, Drifton; Rev. Thomas C. Porter, Prof. J. W. Moore, Dr. Traill Green, Easton; Prof. Lyman B. Hall, Haverford College P. O.; Mr. Ario Pardee, Hazleton; Mr. John Fulton, Johnstown; Academy of Natural Sciences, Engineers' Club, Wagner Free Institute, Numismatic and Antiquarian Society, Philadelphia Library, Drs. W. G. A. Bonwill, H. C. Chapman, George Friebis, W. W. Keene, George R. Morehouse, Isaac Norris, Charles A. Oliver, C. N. Peirce, W. S. W. Ruschenberger, H. Clay Trumbull, Profs. John Ashhurst, Jr., F. A. Genth, Jr., H. D. Gregory, J. P. Lesley, John Marshall, Samuel P. Sadtler, H. W Spangler, Messrs. Henry Carey Baird, William S. Baker S. Castner, Jr., Thomas M. Cleemann, Patterson Du Bois, J. S. Harris, William A. Ingham, W. W. Jefferis, G. de B. Keim, James T. Mitchell, C. Stuart Patterson, Henry Phillips, Jr.,

Franklin Platt, Theodore D. Rand, Samuel Wagner, Talcott Williams, Admiral E. Y. Macauley, Philadelphia; Mr. Heber S. Thompson, Pottsville; Rev. G. W. Anderson, Rosemont, Pa.; Philosophical Society, Messrs. William Butler, Philip P. Sharpless, W. Townsend, West Chester; Maryland Institute, Baltimore; Agricultural Experiment Station, College Park; Leander McCormick Observatory, University of Virginia, Prof. J. W. Mallet, Charlottesville, Va.; Agricultural Experiment Station, Prof. I. C. White, Morgantown, W. Va.; N. C. Agricultural Experiment Station, Raleigh; University of Alabama, University P. O.; Agricultural Experiment Station, College Station, Tex.; Prof. E. W. Claypole, Akron, O.; Cincinnati Observatory; Editor of the "Journal of Comp. Neurology," Granville, O.; Columbia Athenæum, Tenn.; Prof. J. L. Campbell, Crawfordsville, Ind.; Experiment Station, La Fayette, Ind.; Historical Society, Chicago; Academy of Science, St. Louis; Geological Survey of Missouri, Jefferson City; General William F. Reynolds, Detroit, Mich.; Kansas Academy of Science, Topeka; State Historical Society, Madison, Wis.; University of California, Berkeley; Prof. George Davidson, San Francisco, Cal.

Letters of acknowledgment were received from the Tokyo Anthropological Society (135); Société de Geographie,



Free Public Library, Jersey City (96–130, 136, and Catalogue, Parts i–iv).

Letters of envoy were received from the Société de Géographie de Finlande, Societas pro Fauna et Flora Fennica, Helsingfors; Naturwissenschaftliche Verein für Schleswig-Holstein, Kiel, Prussia; K. Sächsische Gesellschaft der Wissenschaften, Leipzig; Société Royale des Sciences, Upsal, Sweden; R. Academia de Ciencias y Artes, Barcelona, Spain; Royal Statistical Society, Lowdon; Boudoin College, Brunswick, Me.; Messrs. J. C. Ayer & Co., Lowell, Mass.; Observatoire Météorologique Central de Mexico.

Accessions to the Library were reported from the Geological Survey of India, Calcutta; Magyar Tudományas Akadémia, Société Hongroise de Géographie, Budapesth; Société de Geographie de Finlande, Societas pro Fauna et Flora Fennica, Helsingfors; Société Royale de Geographie, Antwerp; Gesellschaft für Anthropologie, Ethnologie, etc., Berlin; Naturwissenschaftlicher Verein für Schleswig-Holstein, Kiel; Publishers of the "Revue Universetaire," Paris; R. Academia de Ciencias y Artes, Barcelona, Spain; Royal Society, Royal Geological Society, London; Royal Society, Edinburgh; Philosophical Society, Cambridge, Eng.; Bowdoin College, Brunswick, Me.; Harvard College, Cambridge, Mass.; Prof. William Dwight Whitney, New Haven; Astor Library, Academy of Sciences, American Museum of Natural History, Dr. T. Sterry Hunt, New York; Hon. Thomas H. Dudley, Camden; Mr. Albert S. Gatschet, Washington, D. C.; Public Library, Cincinnati; State Historical Society, Iowa City; Wyoming Agricultural College, Laramie; Missouri Geological Survey, Jefferson City; Dr. John C. Branner, Little Rock, Ark.; Academy of Science, Tacoma, Wash.; Prof. J. de Mendizábel Tamborrel, Mexico.

The Committee appointed at last meeting to examine Prof. Cope's paper for the Transactions, reported it worthy of publication, and was discharged.

The deaths of Theodore Mommsen (February 3, 1892, æt. 75) and T. Sterry Hunt (February 12, 1892, æt. 66) were announced.

On motion, the Society appointed Mr. James Douglass, of New York city, to prepare the usual obituary notice of Dr. Hunt.

The proceedings of the Board of Officers and Council were submitted.

This being the stated evening for balloting for candidates for membership, pending nominations Nos. 1232, 1233, 1234, 1235, 1236, 1237, 1238, 1239 and 1240 were read, spoken to and voted upon.

Prof. Cope made an oral communication on "The Geology of the Staked Plains of Texas."

The Committee on Extended Accommodations presented a final report, and stated that the total cost of alterations to the building had amounted to $41,449.72.

On motion of Dr. Brinton, the report was accepted and the Committee discharged, with the hearty thanks of the Society for its long, arduous and faithful labors.

The Library Committee reported the following minute:

STATED MEETING, FEBRUARY 12, 1892.

The Librarian reported that owing to the advanced condition of the Library he had been able to dispense with the services of the assistants hitherto employed by the Committee, and pursuant to authority granted



declared the following to have been duly elected members of the Society:

2199. Hon. George William Curtis, New York city, N. Y.
2200. Anthony J. Drexel, Esq., Philadelphia.
2201. Prof. Edward A. Leech, Ph.D., Director U. S. Mint, Washington, D. C.
2202. Hon. Seth Low, LL.D., President Columbia College, New York city, N. Y.

Dr. E. D. Cope offered the following amendment to Chapter ix, Section 1, of the Laws:

The ordinary meetings of the Society shall be on the first and third Fridays of every month, from September to the third Friday in June inclusive, at eight o'clock in the evening.

And the Society was adjourned by the President.

Stated Meeting, March 4, 1892.

Present, 27 members.

President, Mr. FRALEY, in the Chair.

Correspondence was submitted as follows:

Acceptances of membership were read as follows:

Mr. Anthony J. Drexel, Philadelphia.

Hon. Seth Low, New York city, N. Y.

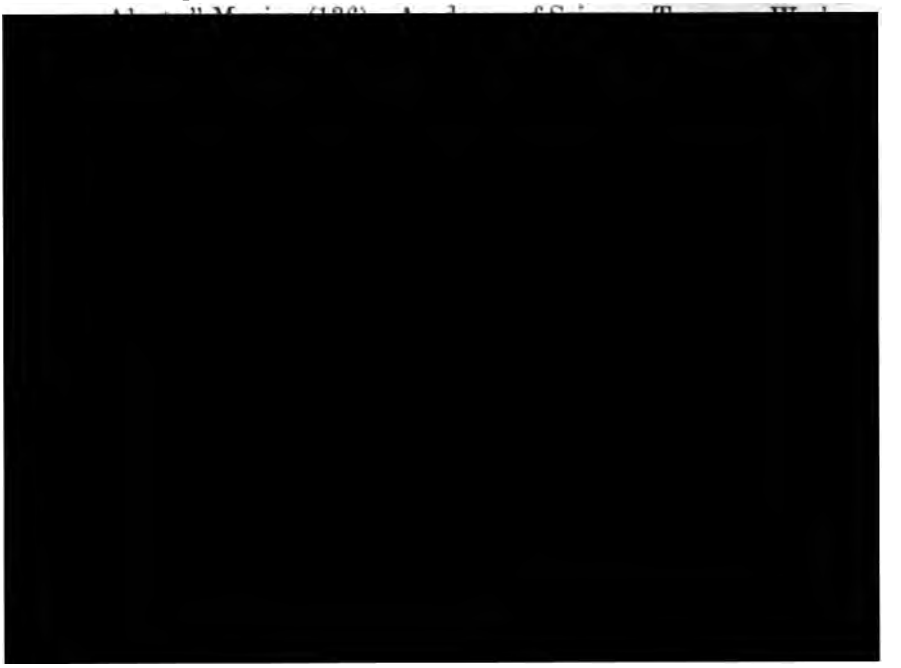
Hon. George William Curtis, West New Brighton, Staten Island, N. Y.

A circular was received from the Linnean Society of New South Wales, announcing the death of its President, Sir William Macleay.

A letter from P. Steiner (Darmstadt) in reference to his language, *Pasilengua*.

Letters of acknowledgment were received from the Institut

Egyptien, Cairo (135); Académie R. Danoise des Sciences, etc., Copenhagen (135); K. Bibliothek, Berlin (135); Deutsche Seewarte, Hamburg (135); Verein für Erdkunde, Netz (135); R. Accademia di Scienze, etc., Padova (135); Natural History Society, Montreal (136); Mr. Hamilton A. Hill, Boston (136); Free Public Library, New Bedford, Mass. (136); Prof. Burt G. Wilder, Ithaca, N. Y. (136); American Museum of Natural History, New York city (97, 99, 100, 101, 127–135); New Jersey Historical Society, Newark (136); Messrs. Cadwalader Biddle, Samuel Dickson, Philadelphia (136); Maryland Historical Society, Baltimore (136); U. S. Naval Observatory, U. S. Coast and Geodetic Survey, Anthropological Society, Patent Office, War Department (136), Department of Agriculture (136), Dr. W. J. Hoffman, Rt. Rev. J. J. Keane, Capt. Thomas Jefferson Lee, Messrs. Charles A. Schott, William B. Taylor, Washington, D. C. (136); University of Tennessee, Knoxville (136); Georgia Historical Society, Savannah (136); University of Cincinnati (99–130, and Catalogue, Parts i–iv); Colonel William Ludlow, Detroit, Mich. (136); Indiana Society of Civil Engineers, Remington (136); Lick Observatory, Mount Hamilton, Cal. (96–130, 136, and Catalogue, Parts i–iv); Sociedad Cientifica "Antonio



Charles A. Oliver, Philadelphia; U. S. Naval Observatory, War Department, Treasury Department, Washington, D. C.; Agricultural Experiment Stations, Virginia, Mississippi, Arkansas; Denison University, Granville, O.; State Historical Society of Wisconsin.

The amendment to the Laws of the Society (Chap. ix, § 1) came up for action. Due proof of advertisement and notice of same having been first submitted, and a constitutional quorum being present, the Society then proceeded to consider the same.

Dr. Cope moved that it be adopted.

Mr. Vaux moved as an amendment that it be indefinitely postponed.

A vote being taken, Mr. Vaux's motion was carried, and the consideration of the amendment was indefinitely postponed.

The Publication Committee reported that the papers by Dr. Cope had been placed in the printers' hands, and that the illustrations to accompany them had been ordered to be prepared; and that Vol. xvii, Part i, had been ordered to be closed and distributed when printed.

Dr. Bonwill read a paper entitled "Geometry and Mechanics Deny Evolution," which he illustrated with diagrams and specimens.

Dr. Cope spoke against some of the propositions set forth by Dr. Bonwill, and exhibited specimens of early dentition from Spuj, Belgium.

Dr. Cope offered for the Proceedings a paper on "Tiaporus, a New Genus of Teiidæ."

Mr. Price, Chairman of the Hall Committee, presented the following report:

TO THE AMERICAN PHILOSOPHICAL SOCIETY:

The Hall Committee respectfully reports that they have carefully considered the matter of a fireproof in the new building to preserve the valuable books, papers and documents belonging to the Society, which was referred by it to them. They have called in consultation with them Messrs. Wilson & Bros., the architects of the building, who have prepared detailed drawings for the construction of a fireproof 4 feet by 14 feet in

the clear inside and reaching from the floor to the ceiling, and situate in the southeast corner of the northern room on second floor, which will afford ample room for many years to come for the protection from fire of valuable books, papers and documents and articles of various kinds, which may need such care and preservation. They have also received an estimate from Messrs. Stacy Reeves & Sons to construct and complete the same for the sum of $278. They therefore submit the following resolution :

Resolved, That the report of the Committee be accepted, and they are directed to have said fireproof constructed under the direction of the architect, in accordance with the plans prepared by them.

All of which is respectfully submitted.

J. Sergeant Price, *Chairman.*

On motion of Mr. Price, the report was accepted, and the resolution contained therein was adopted by the Society.

Mr. Williams offered the following resolution, which after discussion was adopted by the Society:

Resolved, That a Committee of three be appointed by the President, to consider and report to the Society upon the advisability of an annual grant for the purpose of aiding the publication or assuming the entire cost of publishing transcripts of the Babylonian tablets, on deposit in the Museum of the University of Pennsylvania.*

And the Society was adjourned by the President.



Letters of acknowledgment were received from Marquis Antonio de Gregorio, Palermo, Sicily (135); Sir J. W. Dawson, Montreal, Canada (136); Agricultural Experiment Station, Geneva, N. Y. (135, 136); Geological Society of America, Rochester, N. Y. (136); Prof. Henry Morton, Hoboken, N.J. (136); Dr. Charles B. Dudley, Altoona, Pa. (136); Mr. R. Meade Bache, Hon. Henry Reed, Philadelphia (136); Prof. Charles V. Riley, Washington, D. C. (136); State Experiment Station, Baton Rouge, La. (135, 136); Washburn College, Kansas State Historical Society, Topeka, (136); Colorado Scientific Society, Denver, (136); Museo Oaxaqueño, Oaxaca, Mex. (136); Observatorio Astronómico Nacional, Mexicano, Tacubaya (136); Bishop Crescencio Carillo, Merida, Mex. (136).

Accessions to the Library were reported from the Société Litteraire Finnoise, Helsingfors; Colonial Museum, Harlem, Holland; Académie des Sciences, Cracow, Austria; Zoologisch-Botanische Gesellschaft, K. Geologische Reichsanstalt, Anthropologische Gesellschaft, Vienna, Austria; Instituto y Observatorio de Marina, San Fernando, Spain; Rousdon Observatory, Lyme Regis, Eng; Society of Antiquaries, Meteorological Council, London; Editors of the Journal of Philology, Cambridge; American Institute of Electrical Engineers, Prof. J. A. Allen, New York; Mr. William John Potts, Camden; College of Physicians, Mercantile Library, Superintendent of City Trusts, Mr. Henry Phillips, Jr., Philadelphia; Chief of Engineers U. S. Army, Lighthouse Board, Bureau of Ethnology, Washington, D. C.; Mr. William Harden, Savannah, Ga.; Agricultural Experiment Stations, Burlington, Vt., Geneva, N. Y., State College, Centre County, Pa., Baton Rouge, La.

The decease of the following members was announced:

John Couch Adams, Cambridge, England, January 21, 1892, æt. 73.

Dr. Hermann Kopp, Heidelberg, February 20, 1892, æt. 75.

Thomas Hockley, Philadelphia, March 12, 1892, æt. 54.

Dr. Cope presented some additional matter for his paper in the Transactions, which was ordered to be printed.

PROC. AMER. PHILOS. SOC. XXX. 137. P. PRINTED MARCH 30, 1892.

Mr. Phillips presented "A Second Contribution to the Study of the Folk-Lore of Philadelphia and its Vicinity."

Pending nomination No. 1233 was read.

The Library Committee reported a minute of its last meeting.

Mr. Bache offered the following resolution:

Resolved, That, if the funds of the Society permit, this room be now put in charge of a Committee, for the purpose of receiving such treatment to its walls, ceiling, and columns as accord with the character of the Society, and that the Society instruct the Curators to exclude from the cases everything but such printed matter as is desirable for ready reference, and from the floor any articles which are not conducive to the primary purpose in this room of convenience of the members of the Society."

After some debate, the consideration of the resolution was postponed until the next stated meeting of the Society.

Dr. Morris moved that the Secretaries be requested to ask from the Academy of Natural Sciences, the Numismatic and Antiquarian Society and the Historical Society the return of all the articles belonging to this Society that are now deposited with them. After discussion, on motion of Mr. Price, as an amendment, it was resolved to refer the resolution to the Curators for the purpose of ascertaining and reporting to the



A Contribution to the Vertebrate Paleontology of Texas.

By E. D. Cope.

(*Read before the American Philosophical Society, February 5, 1892.*)

I. Fayette Formation.

In the First Annual Report of the Geological Survey of Texas (p. 47), Mr. R. A. F. Penrose, Jr., describes this formation as it occurs in South and East Texas. He places it at the summit of the Tertiary series and below the "Posttertiary;" that is, at the summit of the Neocene, just prior to the advent of the Plistocene. This location is justified by the only vertebrate fossils definitely traceable to these beds, which have been sent me for identification by Dr. E. T. Dumble, State Geologist of Texas. One of these consists of a well-preserved left ramus with symphysis and nearly complete dentition of the mandible of the large lama, *Holomeniscus hesternus* Leidy. This species is characteristic of the Equus beds of Oregon, California and Mexico, and indicates satisfactorily the age of the formation in which it occurs. It confirms fully the position assigned to the Fayette beds by Mr. Penrose. The only other identifiable fossil from this formation is several teeth of the *Equus major* Dekay. This species is most abundant in the Eastern States, where the Equus beds have not been certainly identified; but it occurs also in the Equus bed of Nueces county, Texas, with other characteristic species of that epoch. The specimens of the two species named came from Wharton county. This is the first exact determination of the age of the Fayette formation from paleontological data, and is therefore of much interest, as it enables us to correlate a definite horizon of the East with the Equus bed of the Pacific region. The determination of King and myself that the Equus bed is upper Pliocene is confirmed; since besides Penrose, Chamberlin assures us that the Fayette formation (Appomattox or Orange sand) is pre-glacial.

II. Upper Cenozoic of the Staked Plains.

In some remains of vertebrata, obtained by Mr. W. T. Cummins, from Crosby county, Texas, and sent me for determination by Dr. E. T. Dumble, State Geologist, three genera may be identified, and several others are indicated. The three genera are Equus, Mastodon and Testudo. They are enclosed in a white siliceous friable chalk, which Mr. Louis Woolman finds on examination to be highly diatomaceous. Prof. C. Henry Kain had identified the following species: *Compylodiscus bicostatus* W. Smith; *Epithemia gibba* Ehr.; *E. zebra* Ehr.; *E. gibberula* var. *producta* Ehr.; *Navicula major* Ehr.; *N. viridis* Ehr.; *N. rostrata* Ehr.; *N. elliptica* var. *minutissima* Green; *Gomphonem clavatum* Ehr.; *Cymbella cistula*, Hemp.; *Fragillaria virescens* Raffs var. The formation has been named the Blanco Canyon bed by Mr. Cummins (First Annual Report of the Geol. Survey

of Texas, 1890, p. 190) without exact determination of its position in the Cenozoics.

The Mastodon is of the *M. angustidens* type, as indicated by the teeth, but there are not enough fragments preserved to render it clear whether they pertain to this species or to some allied one. The Equus is allied to the *E. occidentalis* of Leidy, but the enamel plates are more simple than in that species, being the most simple known in the genus. I regard it as an undescribed species, and describe it below under the name of *Equus simplicidens*. A second species of horse is indicated, but an exact determination cannot be made without additional material. The tortoise is a terrestrial form. A water bird of which a tarcometatarse is contained in the collection, is kindly determined for me by Dr. Shufeldt as allied to the rails.

EQUUS SIMPLICIDENS sp. nov.

This species is represented by one nearly entire superior molar of an adult, and one of a young animal, with characteristic fragments of two other superior molars, and several fragments of inferior molars. The size of the teeth is about that of the *E occidentalis* and *E. caballus*. The internal column is of moderate anteroposterior extent, its posterior border marking the anterior third of the posterior lake. Its long diameter is considerably less than half that of the crown. A peculiarity found in two of the superior molars, but not in two others, is that the median dentinal connection between the external and median crescents is interrupted by the continuity of the enamel plates bordering the lakes from the one to the other. This arrangement is frequently seen in the large pm. 3, in the species of Equus, but does not occur in the other pre-



emarginations on the inner border, which are wanting in the present species.*

The species is probably the oldest member of the genus Equus known from North American beds. It is the only species which was contemporary with a Mastodon with the *M. angustidens* type of molars. The simplicity of the enamel foldings is appropriate to this primitive period, as it approximates to the condition seen in many of the three-toed horses and the supposed one-toed *Hippidium spectans* Cope.† The size of the molars is about that of the modern horse, *E. caballus* L.

Observations.—The contemporaneity of this species of Equus with the Mastodon with molars of the *M. angustidens* type has considerable significance. The latter is characteristic of the Loup Fork horizon in North America, in which the genus Equus does not occur. The Equus beds, so named from the abundance of individuals of four species of Equus which they contain, have never produced a specimen of Mastodon allied to *M. angustidens* in North America.‡ The fact that the Equus of the Staked Plains is different from those of the Equus beds, adds to the indication furnished by the Mastodon that these beds do not belong to the Equus horizon; but the presence of the genus Equus is equally conclusive that they do not pertain to the Loup Fork. It is probable that the age of the beds is intermediate. They thus offer an interesting field for further research.

CRECCOIDES OSBORNII, Shufeldt, gen. et sp. nov.

Char. gen.—Only a fragment of a left tarso-metatarsus represents this new genus and species of bird. It evidently belonged to some wader of about the proportions of a medium-sized heron, or to a form rather larger than the Floridan crane-like rail Aramus.

The specimen consists of about the superior moiety of the tarso-metatarsus, and, in so far as it goes, appears to be perfect, with the exception of slight marginal abrasions of the summit of the bone and the almost complete fracturing off of the hypotarsial process. Superiorly, the intercondyloid prominence or tubercle is rounded and not especially conspicuous; the inner condyloid depression is more extensive than the outer one, and occupies a higher plane. In front the shaft is longitudinally excavated only above, the excavation gradually but soon disappearing as we pass down towards the distal extremity; and at the midpart of its

* The horse found in Florida by Mr. Wilcox, which Dr. Leidy identified as his *Equus fraternus* (Transac. Wagner Free Inst. Science, Philadelphia, 1889, p. 16), must be referred to a genus distinct from Equus, on account of the absence of cups of the incisors, by the loss of the internal wall. This is seen in both unworn and worn specimens. In some cases an internal cingulum remains to indicate its position. It appears to be a case of degeneracy. I have named the genus Tomolabis.

† *American Naturalist*, 1887, p. 1072.

‡ It is probable that the *Dibelodon shepardii* Leidy, which has molars of this type, occurs in the Equus beds of the valley of Mexico. Cfr. Cope, Proceed. Amer. Philos. Soc., 1884, May.

continuity it is subcylindrical upon section. A short distance below the head of the bone are seen the usual anteroposterior perforating foramina, here three in number, two being lateral and below, with a mid one just above them. Immediately below these is a single, somewhat prominent tubercle for the insertion of the tendon of the *tibialis anticus* muscle. It occupies nearly a median position upon the shaft. So far as can be ascertained from the imperfect hypotarsial process it would appear that it possessed originally a large, single, inner groove for tendons, with a plate-like projection to its outer side.

Char. specif.—Proximally, the tarso-metatarsus is considerably excavated to the inner side of the hypotarsus at a point just below the summit. The outer muscular line is single and commences at the middle point of the margin of the outer condylar depression, passing from thence down the back of the shaft. The inner muscular line bifurcates proximally, then passes more obliquely backwards than the outer line, to finally pass parallel with the latter also down the back of the shaft.

Measurements.

	MM.
Greatest transverse width of proximal end	15
Greatest anteroposterior diameter of prox. end, not including hypotarsus	11
Distance from apex of intercondyloid tubercle to the tubercle for tib. ant. muscle	10
Vertical depth of hypotarsus	10
Transverse diameter of shaft near its middle	6

Remarks.—This fragment has been compared with the corresponding part of the skeleton in a great many kinds of birds. It was found to differ entirely from all larine, gallinaceous and raptorial types, while on the other hand it seemed to combine the characters of several various species of existing waders and allied groups. The writer compared it with numerous species of the genera Guara, Plegadis, Aramus, Rallus, Crex, Porzana, Ajaja, Tantalus, Botaurus, Ardea, Nycticorax, Grus and the Gallinules, Storks, etc.

For a skeleton of *Crex pratensis* I am indebted to Mr. F. E. Beddard, prosector of the Zoölogical Society of London, and for the loan of other material to the United States National Museum, as well as to Mr. F. A. Lucas, of that institution, for placing the same at my disposal. In the specimen under consideration, the Ralline characters appear to predominate, while more remotely we may see Ibis in its general form and outline. Apart from the question of size it, however, distinctly differs from the tarso-metatarsus in such a form as *Aramus giganteus* in that the shaft was more cylindrical as it approached its midportion, and, as has been said above, did not show the anterolongitudinal excavation in that part. Moreover, in Aramus the hypotarsus exhibits *two* grooves for the passage of tendons, and the tubercle for the insertion of the *tibialis anticus* muscle

is double. Essentially, it agrees with Aramus in the *general form* of its hypotarsus and in the direction of its lateral muscular ridges. In other particulars it exhibited both some minor differences and agreements with the corresponding bone in the skeletons of Crex and Rallus. Upon the whole the specimen would appear to have belonged to some large rail-like wader, now extinct.

The name of the genus I create to contain this form is composed of the two Greek words, κρέξ, a crake, and εἶδος, resemblance. Its specific name is given it in honor of Prof. Henry F. Osborn, of Columbia College, New York, in recognition of his excellent work in paleontology for a number of years past.

The specimen was collected by Mr. W. T. Cummins, and is at present in the possession of Prof. E. D. Cope, to whom the writer is indebted for the honor of having been permitted to describe it.—*R. W. Shufeldt.*

TESTUDO TURGIDA sp. nov.

This species is represented by the greater part of a chelonite of about the size of the *Xerobates agassizii* of Arizona. It is remarkable for the remarkable depth of the dermal sutures and sculpture lines, and for the swollen character of the interspaces which separate both. The general shape is a short, wide oval, with steep to vertical margins.

The plastron is widely emarginate posteriorly, and the anal-femoral dermal sutures form a deep notch in the border. The anal scuta are oblique rhomboids, with equal and nearly parallel sides. The median longitudinal dermal suture is deep and wide, cutting half through the thickness of the plastron. It sends off a branch on each side bounding the gular plates in front. The part of the plastron enclosed in the latter forms two flattened cones appressed together, whose vertical diameter exceeds the transverse, and whose subconic apices are separated by a deep notch. The interclavicular bone is very large and is wide diamond-shaped, the anterior angle being larger than the posterior. The transverse humeropectoral suture is very deep, and is similar to the median longitudinal. The borders of the anterior lobe are strongly convex, with a chord only twice as long as the lateral border of the gular plates.

The nuchal bone has a strongly concave-emarginate border. On the posterior vertebral bones is a seat-like concavity, which is surrounded by a ridge which forms the greater part of a circle. The costal bones are unequally divided by the costal dermal sutures, which are very deep. Each costal scutum is divided into two areas, one of which is marked with ribs parallel to the vertebral axis at one extremity and a seat-shaped plane with a bordering ridge at the other, which is in some of the costals smaller and more swollen. The other half or part of the costal scutal area is swollen in the longitudinal direction, but not for its entire length. The marginal bones are massive and have a subacute border between the bridge and the median points. They are much deeper than long, and are deeply divided by the sutures which separate the dermal marginals. These

grooves cut the margin into deep notches at some points and into shallower ones at others. The areas between these sutures are all swollen in the same way as the alternate parts of the costal plates.

Measurements.

	mm.
Length of plastron anterior to posterior angle of interclavicle	80
Width of plastron anterior to posterior angle of interclavicle	112
Length of interclavicle	40
Width of interclavicle	58
Thickness of interclavicle	11
Length of free lateral margin of gular plate	29
Width of base of both gular plates	45
Length of xiphiplastral bone	32
Width of xiphiplastral bone on anterior suture	53
Width of emargination of posterior lobe of plastron	50
Diameters of free marginal near bridge: anteroposterior	20
Diameters of free marginal near bridge: vertical	34
Diameters of free marginal near bridge: transverse below	25
Diameters of marginal of bridge: anteroposterior	29
Diameters of marginal of bridge: vertical	44
Diameters of marginal of bridge: transverse below	21
Diameters of penultimate vertebral bones: anteroposterior	17
Diameters of penultimate vertebral bones: transverse	30

The American tortoise, which has produced gular areas somewhat like those of this species, is the *Testudo cultratus* Cope of the White River Neocene of Colorado. That species is, however, totally different in the dermal sutures of the usual character, flat marginals, etc., and the gular processes are not conic, but trihedral in form.

The specimen above described comes from Espuella near Dockum, from the same horizon as that of Crosby county, or the Blanco Canyon bed of Cummins.

III. On a Mesozoic Pycnodont.

Microdus dumbelii sp. nov.

This species is represented by a splenial bone of the left side, which supports four and a half rows of teeth. The external two rows include small teeth with crowns, which are either round or slightly transversely oval. The teeth of the third row are larger and the crowns are all transversely oval. The teeth of the fourth row are of unequal sizes, commencing anteriorly of about the same size as those of the third row. The third tooth from the front, as preserved, is much larger, but it is exceeded by the fourth; while the fifth is half as large again as the fourth. The sixth and last is a little smaller than the fifth. The teeth of the fifth row are as

small as those of the first and second rows, and extend posteriorly to the anterior part of the fourth of the fourth row, and not beyond. The crowns of the teeth are perfectly smooth and without keel or depression.

	MM.
Length of tooth series	17
Six teeth of external row	10
Six teeth of third row	11.5
Six teeth of fourth row	16.5
Diameters of fifth of fourth row, anteroposterior	3
Diameters of fifth of fourth row, transverse	7

The horizon of this species is not exactly known, but it is probably Lower Cretaceous. It gives me much pleasure to dedicate it to Dr. E. T. Dumble, Director of the Geological Survey of Texas.

IV. Triassic or Bokum Beds.

The fossils from these beds present a general similarity to those obtained elsewhere in the Trias. Fragments of large Stegocephali are abundant, and Crocodilians of the Parasuchian group are still more so. Teeth like those of the Eastern Clepsysaurus and Zatomus also occur. The number of identifiable species is small, and the best preserved of these is a new representative of the genus Episcoposaurus Cope, already described from the Triassic bed of New Mexico.*

Episcoposaurus haplocerus sp. nov.

I refer to this species the following pieces which were found together by Mr. W. T. Cummins. A dorsal and probably two caudal vertebræ; a scapula of the right side; a few fragments of ribs, and about thirty dermal bones. The generic characters and those of higher value may be first described.

The single dorsal vertebra is from the posterior part of the series. Its articular surfaces are shallowly concave. The neural arch is not entirely coössified, part of the sutural surface being visible in the fracture, from which the neurapophysis has been broken. There is a rib-facet at each end. The smaller, which is longer than deep, is continuous at an open angle with the tubercular articulation of the short diapophysis. The other is longer than deep, lenticular in outline, and terminates acutely above. The scapula is massive, and the inferior extremity is thinned below and turned obliquely inwards. No proscapula. The coracoid facet is not large, and is separated by an angle from the glenoid cavity. The ribs are flat, not very wide, and have one subacute edge. The head of one is attached to the dorsal vertebra, above described. The capitular and articular surfaces are subequal and are separated by an angle. The dermal bones are thick and are united by suture, so as to form transverse bands across the body; but are not united in the anteroposterior direction. Some

*Proceedings Amer. Philos. Soc., 1887, p. 213.

of them have median tuberosities, which are developed in others into horn-like spines. These form rows on the opposite sides of the middle line, as they are unilaterally symmetrical.

Char. specif.—The dorsal vertebra above referred to has the centrum slightly wider than deep. Its inferior surface is contracted on each side, and is slightly concave on the middle line. The surface is smooth. The diapophysis is robust, subtriangular in section, and it does not project freely beyond the centrum. The centrum of a caudal vertebra with chevron facets, is deeper than wide, and has robust diapophyses, which spring principally from the centrum. The outline of the articular face is a hexagon elongate vertically. This is partly due to the broad truncation of the inferior face. Concavity of centrum slight.

Measurements of Vertebræ and Ribs.

		MM.
Diameters of dorsal	anteroposterior	66
	vertical	64
	transverse	75
Diameters of caudal	anteroposterior	52
	vertical	59
	transverse	51
Vertical diameter of head of rib attached to dorsal, above mentioned		46
Transverse diameter of capitulum of do.		26
Transverse diameter of shaft of another rib		40
Thickness of shaft of another rib		15

The section of the scapula is everywhere lenticular. It is robust, rather short, without much constriction at the base, and but a moderate expan-



plate. This tuberosity is in some of the plates developed into a prominent spine or horn, which has an anteroposteriorly oval section. The surfaces of the tuberosities are punctate. These horns are placed on the sides, and probably not far from the median line, since they form with the adjacent tuber-bearing plates a strong angle, such as would be necessary to enclose the neural spines of the vertebral column. It is also not certain whether these spines were on the dorsal, cervical or caudal regions, or whether they were on all of them. The plates adjacent to those bearing spines are the most robust. The spines are gently curved, probably backwards.

Measurements of Dermal Plates.

		MM.
Diameters of plate without knob	anteroposterior	90
	transverse	78
	vertical at suture	18
Diameters of plate with knob	anteroposterior	100
	transverse	70
	vertical at suture	37
Diameters of plate with spine	anteroposterior	115
	transverse (chord)	65
	vertical at suture	35
Elevation of spine of plate last, measured from base (apex restored)		190
Diameters of spine at base	anteroposterior	95
	transverse	65
Diameters of spine 45 mm. below apex	anteroposterior	30
	transverse	20
Diameter of pits on flat bone		5
Diameter of pits on knobbed bone		9

In *comparison* with the only species of the genus known thus far, the *E. horridus*, from the Triassic bed of New Mexico, the present species has the tuberosities and horns of a different shape. In that species the former are compressed and keel-like, and the horns are also compressed, having an edge in front and a triangular section. The individual which served as the basis of the description of the *E. horridus* is also of rather smaller size than the present one.

On Tiaporus, a New Genus of Teiidæ.

By E. D. Cope.

(*Read before the American Philosophical Society, March 4, 1892.*)

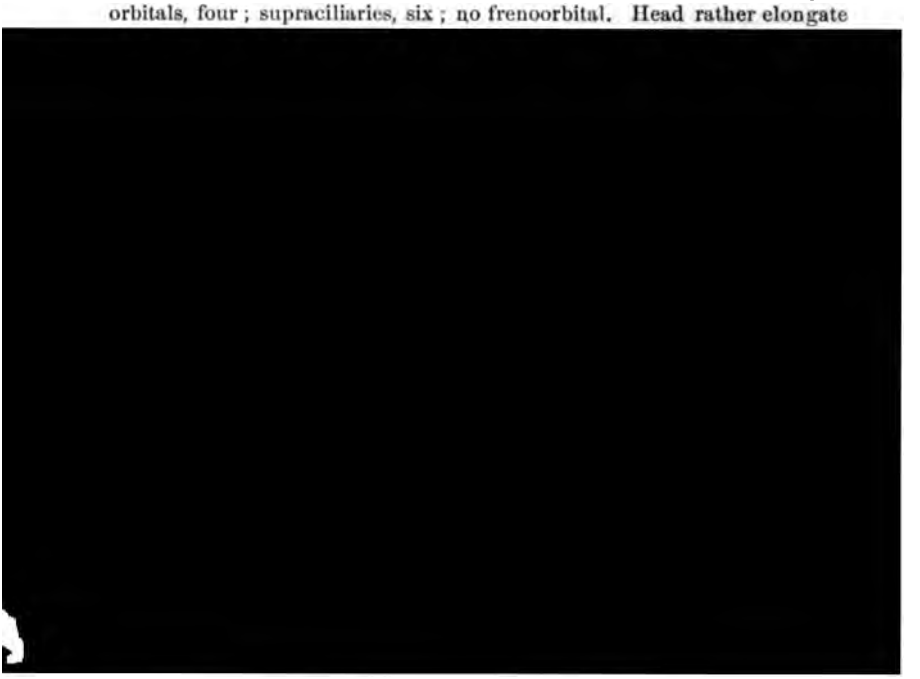
TIAPORUS FULIGINOSUS, gen. et sp. nov.

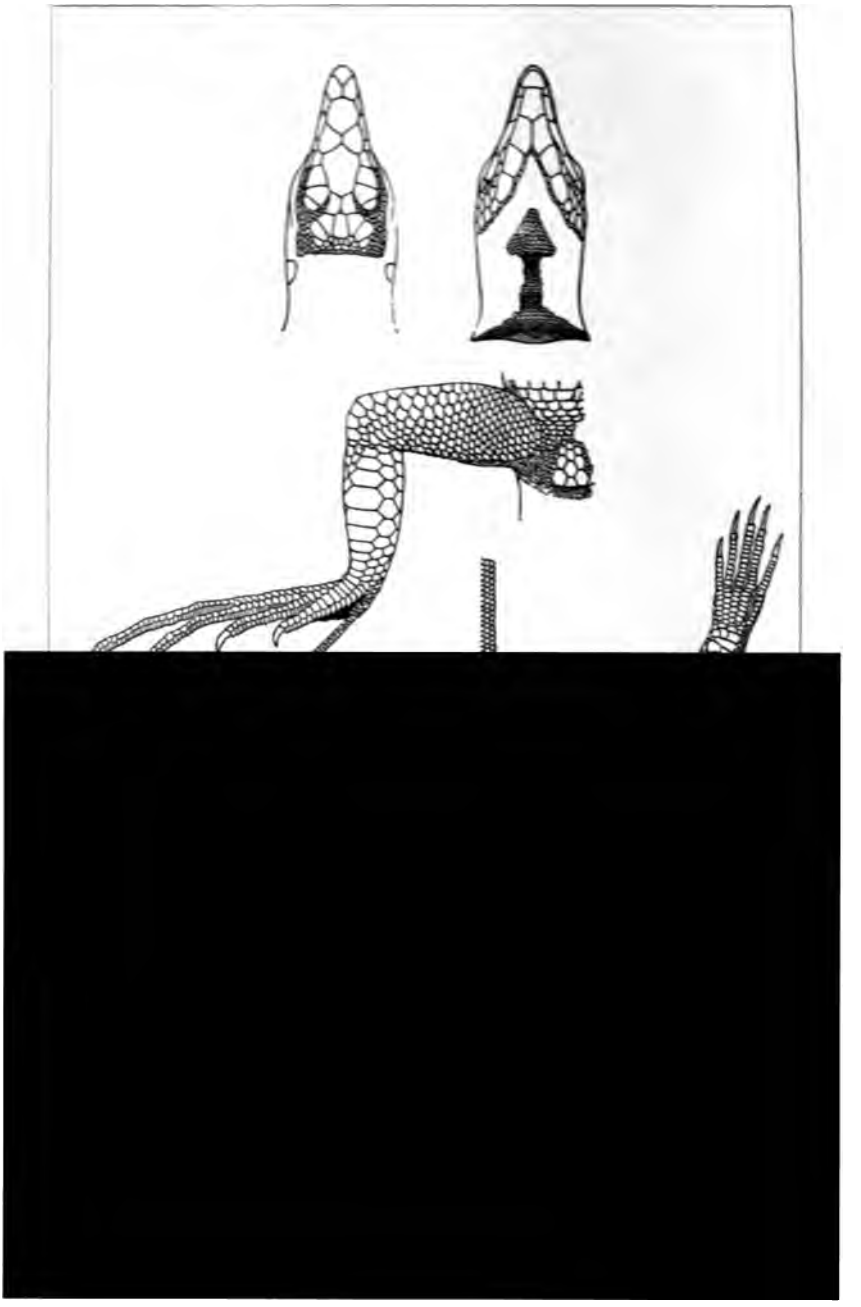
Char. gen.—Tongue cylindric and sheathed at the base; no femoral pores; abdominal scales smooth; a cervical collar fold; tail cylindric. Digits 5–5.

This form is identical with Amiva, except in the absence of femoral pores. Monoplocus Gthr. has no femoral pores, but the tongue is not sheathed, and the abdominal scales are keeled.

Char. specif.—The squamous surface of the tongue is ovate posteriorly and not notched. The apex of the tongue is deeply bifurcate. The teeth of the maxillary bone are compressed, and have a principal compressed apex, and one or two denticles of the edges near the base. The rosettes of scales, which in other genera surround the femoral pores, are present, but the pores are absent.

The animal is about the size of the *Amiva corvina* Cope. The dorsal scales are minute, measuring .02 mm. The abdominal plates are in twelve longitudinal and thirty-two transverse rows. They are smooth, and those of the external row are smaller than the others. The nostril is on the suture between the nasal plates. The pariëtals are divided into two and sometimes into three plates, the internal of which is wider than the interpariëtal. The latter is smaller than each frontopariëtal. Supraorbitals, four; supraciliaries, six; no frenoorbital. Head rather elongate





anteriorly; in one of these also an interrupted black lateral band below the one already described. Below this there are in the same specimen two rows of blackish spots on the sides, the inferior on the lateral ventral scales. In a ♀ there is a row of small pale spots above and below the superior lateral black band.

Total length, 310 mm.; length to angle of mandible, 30 mm.; do. to collar, 38 mm.; do. to axilla, 45 mm.; do. to vent, 108 mm.; do. of fore-leg, 40 mm.; do. of forefoot, 17 mm.; do. of hind leg, 83 mm.; do. of hind foot, 47 mm.

This remarkable species has no particular resemblance to any known species of Amiva or Cnemidophorus. Four specimens, No. 14,710 U. S. National Museum Register, from Swan Island in the Caribbean Sea Collected by Charles Townsend.

Swan Island is off the northeastern coast of Honduras, at a distance of about two degrees of latitude. It is about five degrees west by south of Jamaica. It was visited by the U. S. Fish Commission steamer *Albatross*, and Mr. Townsend, the naturalist of the expedition, obtained this species with several others. The present form is related to Amiva as Monoplocus is to Centropyx.

Explanation of Plate.

Fig. 1. Head profile: *a*, from above; *b*, from below; fig. 2, anterior limb from above; *b*, forearm from below; fig. 3, hinder limb with anal region from below; fig. 4, portion of side of body.



time be awarded by the Society for the best essay of real merit on the Science and Philosophy of Jurisprudence, and to the preparation of the certificate to be granted to the author of any successful essay.

Fourth. Competitors for the prize shall affix to their essays some motto or name (not the proper name of the author, however), and when the essay is forwarded to the Society, it shall be accompanied by a sealed envelope containing within the proper name of the author, and, on the outside thereof, the motto or name adopted for the essay.

Fifth. At a stated meeting of the Society, in pursuance of the advertisement, all essays received up to that time shall be referred to a Committee of Judges, to consist of five persons, who shall be selected by the Society from nomination of ten persons made by the Standing Committee on the Henry M. Phillips' Prize Essay Fund.

Sixth. All amounts of interest accruing and unexpended on each and every occasion on which no prize shall be awarded, shall be considered and taken as accretions to the principal of the said fund.

Seventh. All essays may be written in English, French, German, Dutch, Italian, Spanish or Latin; but, if any language except English, must be accompanied by an English translation of the same.

Eighth. No treatise or essay shall be entitled to compete for the prize that has been already published or printed, or for which the author has received already any prize, or profit, or honor, of any nature whatsoever.

Ninth. All essays must be clearly and legibly written on only one side of the paper.

Tenth. The literary property of such essays shall be in their authors, subject to the right of the Society to publish the crowned essays in its Transactions or Proceedings.

Eleventh. A Standing Committee, to consist of five members appointed by the President, and, *ex officio*, the President and the Treasurer of the Society, shall continue in office during the pleasure

of the Society, and any vacancies that may occur in said Committee shall be filled by new appointment by the President.

Twelfth. The said Committee shall have charge of all matters connected with the management of this endowment and the investment of the same, and shall make such general rules for publishing the terms upon which said prize shall be competed for, and the amount of the said prize, and, if it shall deem it expedient, designate the subjects for competing essays. It shall report annually to the Society, on the first Friday in December, all its transactions, with an account of the investment of the Prize Fund, and of the income and expenditures thereof.

The first prize to be awarded by the Society will be the sum of one thousand dollars, lawful gold coin of the United States of America, and all treatises in competition therefor must be in the possession of the Society

PROCEEDINGS

OF THE

AMERICAN PHILOSOPHICAL SOCIETY,

HELD AT PHILADELPHIA, FOR PROMOTING USEFUL KNOWLEDGE.

VOL. XXX. APRIL, 1892. No. 138.

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☞ It is requested that the receipt of this number be acknowledged.

☞ In order to secure prompt attention it is requested that correspondence be addressed simply "To the Secretaries of the American Philosophical Society, 104 S. Fifth St., Philadelphia."

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EXTRACT FROM THE LAWS.

CHAPTER XII.

OF THE MAGELLANIC FUND.

SECTION 1. John Hyacinth de Magellan, in London, having in the year 1789 offered to the Society, as a donation, the sum of two hundred guineas, to be by them vested in a secure and permanent fund, to the end that the interest arising therefrom should be annually disposed of in premiums, to be adjudged by them to the author of the best discovery, or most useful invention, relating to Navigation, Astronomy, or Natural Philosophy (mere natural history only excepted); and the Society having accepted of the above donation, they hereby publish the said

PROCEEDINGS

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VOL. XXX. APRIL, 1892. No. 138.

A Sketch of the Life of Joseph Leidy, M.D., LL.D.

By W. S. W. Ruschenberger, M.D.

(*Read before the American Philosophical Society, April 1, 1892.*)

The Academy of Natural Sciences, of Philadelphia, devoted the stated meeting of May 12, 1891, to commemorate its President, Dr. Joseph Leidy, who died April 30. The meeting was very large and impressive. Drs. William Hunt, Harrison Allen, Henry C. Chapman, James Darrach, Edward J. Nolan, Prof. Angelo Heilprin and Mr. Joseph Wilcox, by appointment, delivered appropriate addresses; and the Rev. Dr. H. C. McCook, Mr. Isaac C. Martindale, Dr. James J. Levick and others eulogized the dead President.

A more affectionate tribute has seldom been paid in this city to the memory of a votary of science. Ample testimony was adduced that Dr. Leidy had attained distinction among scientific men at home and abroad, and that he had the warm sympathy and respectful regard of all those members of the Society with whom he had been in any degree associated.

In the first hours, while a great bereavement is still fresh, love and admiration so obstruct perception that the extent of the loss sustained may be sometimes overstated. But let whoever may conjecture that in this instance some of the addresses were too fervid, consult the cold records of the Academy in which are faithfully set down his works since he entered the Society, and he will find that they justify the encomiums pronounced.

Loyalty to truth and ingenuousness were shining features of Dr. Leidy's nature.

The first paragraphs of Dr. William Hunt's opening address on Dr. Leidy's personal history are cited here in illustration:

"It is fitting that we imagine the beloved subject of our discourses this evening to be with us in spirit, as he doubtless is in influence, and to let him introduce himself as I heard him do in Association Hall some years ago when he was about to give a popular lecture. I was unexpectedly called upon to introduce him. 'What!' said I. 'Who is to introduce the introducer? Here's a man more widely known to the city and to the

world than any of us.' Dr. Leidy, hearing the conversation, said: 'Oh! Dr. Hunt, keep your seat; I don't wish to be introduced; I'll introduce myself.' And, stepping to the rostrum, he spoke in this way:

"'My name is Joseph Leidy, Doctor of Medicine. I was born in this city on the 9th of September, 1823, and I have lived here ever since. My father was Philip Leidy, the hatter, on Third street above Vine. My mother was Catherine Mellick, but she died a few months after my birth. My father married her sister,* Christiana Mellick, and she was the mother I have known, who was all in all to me, the one to whom I owe all that I am. At an early age I took great delight in natural history and in noticing all natural objects. I have reason to think that I know a little of natural history, and a little of that little I propose to teach you to-night.'"

Dr. Leidy's ingenuous introduction of himself suggests that a fuller account of his ancestors may be acceptable.

Carl Leidy, the forefather of the American-born Leidys, came to America from Rhenish Germany in the early part of the eighteenth century (about 1724), and settled in that part of Penn's province which now includes Montgomery and Bucks counties, Pa.†

**Erroneous.*—His mother died May 28, 1825 (soon after her son Thomas was born), twenty months after the Doctor's birth. His father's second wife was a cousin and not a sister of Dr. Leidy's mother, as stated. See, The Story of an Old Farm, or Life in New Jersey in eighteenth century. By Andrew D. Mellick, Jr., Somerville, New Jersey, 1889.

†*Genealogical Notes.*—Carl Leidy's son, Carl Ludwig, b. Dec. 30, 1729, and his wife, Ursula Elizabeth, b. Feb. 8, 1734, had issue: (1) John Jacob, b. Nov. 7, 1753; (2) George Heinrich, b. Oct. 19, 1755; (3) Margaretta, b. Nov. 15, 1757; (4) Eva Christina, b. Dec. 25, 1759; (5) Anna, b. Oct. 1, 1761; (6) Magdalena, b. Dec. 18, 1763; (7) Carl, b. Aug. 20, 1765; (8) Anna Maria Elizabeth, b. Feb. 24, 1768; (9) George Ludwig, b. July 1, 1770; (10) Maria Catherine, b. May, 1772. Both parents and children were natives of Hilltown township, Bucks county, Pa.

John Jacob Leidy, the first-born of this family, m. April 18, 1777, Catherine, b. March 16, 1757, a daughter of Christian Comfort. They had issue: (1) Charles Ludwig, b. Jan. 7, 1778; (2) Henry, b. Jan. 12, 1779; (3) Catherine, b. May 16, 1780; (4) Maria Margaretta, b. March 1, 1781; (5) Jacob, b. Jan. 10, 1782; (6) Christian, b. Jan. 3, 1784; (7) George, b. Oct. 7, 1786; (8) Conrad, b. Nov. 25, 1788; (9) Philip, b. Dec. 5, 1791, d. Oct. 9, 1862; (10) Emanuel, b. Dec. 22, 1794; (11) Frances Fanny, b. March 6, 1798. All were natives of Hilltown township, Bucks county, Pa.

Philip Leidy, the ninth child of the preceding family, m. Oct. 6, 1818 (he was then settled in Philadelphia), Catherine, a daughter of Peter and Rachel Mellick. She was born in Bloom township, Columbia county, Pa., Jan. 27, 1790, and died in Philadelphia, May 28, 1825. They had issue: (1) Peter, b. Dec. 28, 1819, d. Aug. 29, 1820; (2) Catherine, b. Aug. 7, 1821, d. Nov. 20, 1822; (3) Joseph, b. Sept. 9, 1823, d. April 30, 1891; (4) Thomas, b. May 21, 1825, d. April 20, 1870.

Philip Leidy m., May 25, 1826, Christiana Taliana, a cousin of his first wife. She was born in Philadelphia, July 29, 1797, and died Jan. 6, 1881. They had issue: (1) Christiana T., b. Feb. 22, 1827, m. June 4, 1839, James Cyrus Umberger, d. Oct. 24, 1878; (2) Francis, b. Dec. 14, 1828, d. June 3, 1856; (3) Asher, b. July 30, 1830, d. July 6, 1878; (4) Helen, b. Sept. 30, 1833, d. Dec. 3, 1839; (5) Catherine Mellick, b. March 28, 1837, d. Aug. 12, 1839; (6) Philip, b. Dec. 29, 1838, d. April 29, 1891. All born in Philadelphia.

Peter, the forefather of the Mellick family, came to America from Rhenish Germany about the close of the sixteenth century (1695).

German and English, it may be said, were vernacular languages to the members of the Leidy and Mellick families generally—the German came to them as a birthright, and English from their environment.

The name first appears in the City Directory for 1809—"Leidy, Jacob, shoemaker, 9 Summers' Court." Prior to that year the Leidys probably lived either in Bucks or Montgomery county. All of them who exchanged a country for a city residence were of the class called "plain people," composed of well-to-do and respectable workers—men whose individual energies when united constitute the national strength and are almost exclusively the progenitors, in aftermaths, of millionaires, consequently of aristocratoid or "first families" and gentry, often more boastful of ancestry than of creditable achievement. The name of Philip Leidy, hatter, the father of our subject, first appears in the City Directory for 1817, and that of his brother, Conrad, bootmaker, in 1820. At those dates they were established in business. During several years before that time they resided in the city. Both volunteered in the War of 1812-15 against Great Britain and served with those at Camp Du Pont. The Leidys named in the City Directories for 1809 and for several years thereafter were mostly mechanics, makers of hats, boots, chairs, etc., and probably had been apprentices and learned their trades in the city. One of their contemporaries, now an influential citizen advanced in years, remembers that "all the Leidys were smart."

Philip Leidy, who was born in Montgomery county, Pa., December 5, 1791, is spoken of as a powerful man whose stature was rather more than six feet and in every way well proportioned. Though not conspicuous for mental force he was naturally endowed with practical good sense. His educational acquirements were limited; but his industry, honesty and frank deportment secured him confidence and respect wherever he was known. He made and sold hats, did a good business, and had many customers from the adjoining counties as well as in the city. He was a member of the German Lutheran Church in New street, and with his family habitually attended its services.

Dr. Leidy said in his self-introduction, every word in a halo of grateful love, my stepmother "was the only mother I have known, who was all and all to me, the one to whom I owe all that I am."

Besides being notable in the management of domestic affairs, she possessed a large share of tact and of good womanly qualities. She was intellectually the superior of the family, had literary taste, wrote verses sometimes, was ambitious, and desired that her children should be well educated and that her sons should study the professions.

Through her influence Joseph, at the age of about ten years, was sent to the Classical Academy, a private day-school conducted by the Rev. William Mann, a Methodist clergyman. There he studied English and read Latin—Historia Sacra, Viri Romæ and Virgil—the principal being scrupulously careful that his pupils should understand the grammar. Probably he began Greek also.

Minerals and plants interested him at an early age. Mr. Mann encouraged the cultivation of this taste. One day an itinerant lecturer from the so-called "Universal Lyceum" visited the school, and, by permission,

discoursed about mineralogy, illustrating his lesson with specimens. Young Leidy was so much interested that soon after he procured books on mineralogy and botany and diligently studied them. At length he became so fascinated in the pursuit that he often absented himself from school without leave to seek specimens in the rural districts near the city. Parental chidings for delinquencies of this kind did not always restrain him. His self-will and eagerness to hunt for minerals and plants often caused him to forget those admonitions and follow the inclination of the hour.

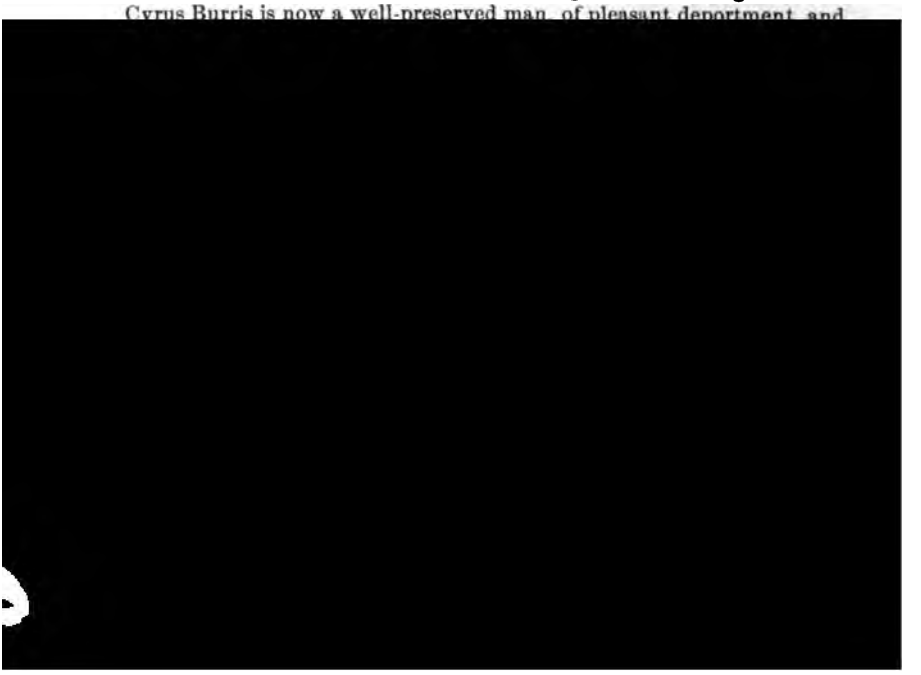
The conduct of the boy, his spontaneous ways, are in many instances forecasts, in outline, of the characteristic features of the man he will become; and therefore it is interesting to observe those surroundings which may influence their development.

At the time Joseph entered the academy, Mrs. Burris, a respectable colored woman, a widow, lived near and did laundry work for support. Her son, Cyrus, a bright youth a few years older than Joseph, was errand boy in the hatter's shop. His chief duty was to deliver hats at the homes of their purchasers, and for each errand of the kind he received six or twelve cents, according to the distance he had to walk.

There were then three schools at no great distance apart. Mr. Collom and Mr. Livensetter charged three dollars a quarter for each pupil and Mr. Mann twelve dollars. The boys of the two schools were at war with those of the academy, and they had a fight whenever they met in the street.

Apprehensive that her son might be assaulted by some of those "rowdy boys," Mrs. Leidy engaged Cyrus to accompany him to school. These two became intimate friends and often went together botanizing.

Cyrus Burris is now a well-preserved man, of pleasant deportment, and



questions, regarding him as a poor, intelligent boy who was striving to instruct himself. This was the beginning of an enduring friendship. In a short time Mr. Kilvington cheerfully assumed to be his systematic instructor, and, after his pupil had become distinguished, complacently mentioned to friends that he had been Leidy's botanical preceptor.

On one occasion Cyrus and the young professor spent a whole day in Bartram's garden, near Gray's Ferry, and did not reach home till night.

"The professor," as Cyrus styled him, "used to say that the valley of the Wissahickon was the best place in the neighborhood to find plants. He very soon knew more about them than I did. Sometimes we went all day with nothing to eat but raw turnips we got out of the fields, for the old man was stingy of spending-money to his boys, though he was always a bountiful provider of the very best things in the market for them at home. Once we went into Jersey, and that was the only time I ever cheated the professor. We saw in a thick bush a big snake, four or five feet long, with a white spot under his throat. The professor wanted to catch him, so he gave me a carpet bag to hold open on one side of the bush for the snake to run into, while he frightened him out from the other. The snake came hissing along towards me. I jumped aside—I couldn't help it—and let him get away, but I never let on that I was scared."

In the course of his schooldays the young naturalist, besides gathering stones and plants, caught butterflies and bugs, which he pinned in a box prepared for the purpose, to be arranged in his cabinets at home.

Cyrus stated, among other things, that he sometimes acted as caterer and waiter for the lads on special occasions; and that whenever the boys came into the hatter's shop, their father always talked to them in German. He also said that Dr. Leidy had taught him a great deal about plants and their medicinal uses, adding, "Through what I learned from him, I have been able through many years to make a decent living."

The offspring of almost constant companionship during their boyish days, at home or in the fields, was a personal sympathy, a friendship which, to the credit of both, was life-long, notwithstanding the extreme difference and distance between the social places each occupied in adult age. The professor gave him, at different times, several books on medicine, and among them his *Elementary Treatise on Anatomy*, in which is written, "To Cyrus Burris, from his old friend, the author." These are Cyrus' treasures. He quietly but, no doubt, proudly shows them to a favored few.

The future professor did not own shinny or hockey stick, kite, skates nor ball; never played marbles, nor whistled nor hummed a tune at any time.

He was a good boy in school, always neat and tidy, and never joined his schoolmates in their out-of-door sports during the hour of daily "recess," but sat the while at his desk, pencil in hand, portraying some natural object, as a snail shell, carefully and beautifully shading it, or drawing caricatures suggested by acts of his fellow-pupils.

He had no teaching to develop this talent. The high artistic skill which he acquired was exclusively due to self-cultivation. A small book of his portraits of shells, dated February, 1833, has been preserved, which show his skill with a pencil in his tenth year.

According to his school champion, who, the boy always declared was the best Greek scholar in the academy, "Joseph Leidy never sized up to the other boys."

His schooldays ended in his sixteenth year, probably about the last of July, 1839.

His worldly condition required that he should now be taught some art by which to earn a livelihood. As he had manifested at an early age uncommon aptitude in draughting and drawing, his father conjectured that he would best succeed as a sign painter. But the son, who had passed much of his leisure in the wholesale drug store of his cousin, Napoleon B. Leidy, M.D., "physician and druggist," as the City Directory styled him, fancied that he would rather be an apothecary.

In compliance with his preference he was placed with an apothecary and in the course of a few months acquired such a degree of knowledge of drugs and the method of compounding them, that he was considered qualified to be left in temporary charge of the retail business.

His loving stepmother, however, was not satisfied. She seemed sure that there was in him the making of a successful physician. Her arguments at last prevailed. With the consent of his father, rather reluctantly given, it was agreed that he should study medicine.

In the autumn of 1840, he became a pupil of Dr. James McClintock, then a private teacher of anatomy in College avenue. His father's proposition to pay the preceptor's fee in hats was accepted, but the settle-



Robert Hare, Professor of Chemistry, during six weeks, and then entered that of Dr. James B. Rogers, lecturer on Chemistry in the Medical Institute of Philadelphia, from 1841, and remained there through the summer course. On the retirement of Dr. Hare, in 1847, Dr. Rogers succeeded him in the University.*

He was now prepared to begin the practice of any branch of medicine he might prefer, but he had yet to learn how to make the profession of commercial value to himself. No plan of proceeding was immediately formed. In August, 1844, on foot with several companions, he visited Harvey's lake, Bethlehem, Mauch Chunk; also the Beaver Meadow and Hazleton coal mines. In a letter to a sister he wrote: "Pedestrianated to Wilkesbarre and arrived at Berwick yesterday, August 28, having walked from the lake to this place, thirty-five miles, the longest distance I have ever walked in one day."

In the autumn he opened an office, No. 211 North Sixth street, hoping to obtain employment as a general practitioner. But the business which came to him during two years' trial did not promise a satisfactory living, and therefore he determined to devote himself exclusively to teaching. Possibly his failure to obtain practice was ascribable in some degree to lack of due attention to patients. Years after this time, to show how intently attractive comparative anatomy was to him, he related to his private class that on one occasion he was so absorbed in his office studying the anatomy of a worm that he totally forgot that he had been called to an obstetric case which he had engaged to attend. Later in life he would have felt that unbridled eagerness to learn the structure of a worm is an inadequate plea for forgetting a professional or other engagement.

An unhappy experience, which occurred shortly after he began the practice, tended to disgust him with it and may have been one reason among others why he abandoned it. Ten years afterwards he narrated substantially that, called to a child suffering "with all the symptoms of tubercular meningitis," he informed the parents that medicine in such a case is inefficacious. Nevertheless, they requested him to visit it. At the end of a week a much older practitioner was called, and attended the child till it died. He then "informed the parents that he could have saved the life of the patient had he been called at the time of Dr. Leidy's first visit."†

In 1845, on the resignation of Dr. Goddard and the appointment of Dr. John Neill, Demonstrator, in his place, the Professor of Anatomy,

* Biographical Notice of Joseph Leidy, M.D. By the Editor. "The New Jersey Medical Reporter and Transactions of the New Jersey Medical Society." Edited by Joseph Parrish, M.D., Burlington, N. J. Published by S. W. Butler, M.D. Ninth month, September 30, 1853, Vol. vi, No. 2. It is understood that this notice had the approval of Dr. Leidy.

† See p. 16, Valedictory Address to the class of medical graduates of the University of Pennsylvania, delivered at the public commencement, March 27, 1858. By Joseph Leidy, M.D., Professor of Anatomy. Published by the Graduating Class. Collins, Printer, Philadelphia, 1858.

Dr. Horner, appointed Dr. Leidy his prosector. In 1846 he was chosen Demonstrator of Anatomy in the Franklin Medical College, but resigned the office at the close of the session, in 1847, resumed his position with Dr. Horner and delivered to his students a private course of lectures on Human Anatomy.

He indulged himself with a short vacation in July, 1846, and visited his friends, Messrs. Haldemann, at Chickies, Pa.

While his kinsman, Dr. N. B. Leidy, was Coroner of the County of Philadelphia (1845–48), he acted as Coroner's Physician and received fees for the autopsies he made.

In the spring of 1848, impaired health induced Prof. Horner to visit Europe. He invited his friend, Dr. Leidy, to be his traveling companion. They sailed in April and returned in September. In England, Germany and France they "visited hospitals and anatomical museums, and sought out eminent anatomists and surgeons." Dr. Leidy witnessed in Paris, June 20, some vivisection experiments by Magendie, in his physiological laboratory, which interested him. They "were in Vienna while the revolutionary movements were in progress:" and "were also in Paris during the fierce conflicts from 23d to 26th of June; and during several days afterwards they "witnessed in the hospitals, filled with wounded, every variety of gunshot wound and the modes of treatment pursued."*

On his return from Europe, in the autumn, Dr. Leidy delivered a course of lectures on Microscopic Anatomy; and in the spring of 1849 began a course on Physiology in the Medical Institute of Philadelphia, which the condition of his health required him to abandon.†

He edited *Qwain's Human Anatomy*, which was published June, 1849, by Lea & Blanchard.



didactic method of instruction. For this reason he was confident that it would be equally useful, though perhaps more difficult to accomplish, in teaching that to which materia medica is merely subservient. With special reference to his intended system of instruction, he visited the most celebrated schools in Europe, and at a cost of many thousands of dollars, purchased models, castings and drawings of many pathological specimens. "These formed a cabinet of morbid representations unique in this country, and supplied material for a course of medical tuition which was as instructive and satisfactory as it was interesting and novel."*

Dr. Wood was the first to teach the practice of medicine in a series of "object lessons," by placing before his class models, casts, etc., appropriate to the illustration of each lecture.

At the end of his holidays in Europe, Dr. Leidy resumed his routine work in the University. He was elected a Fellow of the College of Physicians of Philadelphia, August, 1851. He seemed to be not much interested in the pursuits of the Society; seldom attended its meetings, and was not a contributor to its Transactions.† He was Secretary of the Committee on Lectures, under the Mütter Trust, from January, 1864, and kept a neat record of its proceedings. In November, 1883, "on account of his scientific achievements," the College exempted him from future payment of annual contributions.

He lectured on Physiology in the Medical Institute of Philadelphia in the summer courses of 1851 and 1852.

He was appointed in 1852 Pathologist to St. Joseph's Hospital, a purely nominal position.

Failing health had disabled Prof. Horner. With approval of the Trustees and the Medical Faculty of the University, Dr. Leidy, as his substitute, delivered the course of lectures on Anatomy for 1852–53.

Dr. Horner died March 13, 1853, and in May Dr. Leidy was elected Professor of Anatomy.

He was yet in the thirtieth year of his age. His educational opportunities and collateral advantages may have been less than those of his predecessor and friend, but from the hour he resolved to be a teacher he probably hoped some day to fill a Professor's Chair. The unremitting exercise of his natural abilities, his ever eager quest of knowledge enabled him to publish, prior to this time, many works which won for him praise

* Memoir of George B. Wood, M.D., LL.D. By S. Littell, M.D. (read October 1, 1879). Transactions of the College of Physicians of Philadelphia, Vol. xii, 1881.

† At a meeting of the College, May 5, 1886, he related that he had recently examined three nematoid worms, found in the intestines of young cats, sent to him from Chicago, and read a letter from Durango, Mexico, reporting the great prevalence of scorpions in that district. He also exhibited "photographs of trichinæ in the flesh of the pig." In answer to a remark by a Fellow of the College that it had been repeatedly stated in Berlin that the trichinæ had been found there in the pig, prior to the time when Dr. Leidy announced his discovery of it, he said: "I believe mine was the first notice of the parasite occurring in the pig." *Transactions of the College of Physicians of Philadelphia*, third series, Vol. viii, 1886, pp. 41–43.

and a name, and proved him to be an eligible candidate, and, after an unusual trial of his aptitude for the office, fairly secured his preferment.

A brief notice of his predecessors in the same Chair is submitted to show in what respects he resembled them.

The medical department of the University of Pennsylvania has always been happy in selecting men of marked ability and acquirements to fill its professorships. At the start the Trustees elected (September, 1765) two professors. Dr. John Morgan, to whom the credit of founding the Medical School of the University belongs, was appointed Professor of Medicine, which embraced the practice of physic, materia medica and pharmaceutical chemistry, and Dr. William Shippen, Jr., Professor of Anatomy and Surgery, when he was twenty-nine years of age. He also taught midwifery. Their first courses of lectures began in November, 1765. He was an eminent general practitioner of medicine and a surgeon of the Pennsylvania Hospital during nearly twelve years.

Dr. Caspar Wistar, at the age of thirty-one years, was appointed, January, 1792, adjunct, and after the death of Dr. Shippen, July 11, 1808, Professor of Anatomy.

Desirous to improve the method of teaching anatomy, Dr. Wistar had made gigantic models, exactly proportioned, of several minute and intricate structures—of the internal ear, for instance—which he used as objective illustrations of his lectures.

His collection of numerous models and anatomical preparations was presented, after his death, by his family to the University, and by resolution of the Trustees, styled "The Wistar Museum."

Dr. Wistar published, in 1811, *A System of Anatomy*, which was a text-book during many years. He was versed in botany, mineralogy and chemistry. He was a surgeon of the Pennsylvania Hospital more than



twenty-four years. His private practice was large. In 1823 he published *A Treatise on Practical Anatomy;* in 1826, *A Treatise on the Special Anatomy of the Human Body,* in two octavo volumes, which passed through eight editions, and at different times contributed valuable papers to the medical journals.

The numerous pathological and anatomical preparations made by himself, which were appraised at $10,000, he bequeathed to the Wistar Museum. In acknowledgment of this valuable bequest, the Trustees of the University decreed that it should be named thenceforward the Wistar and Horner Museum.

The anatomical chair, under the lustre shed upon it by the professional skill and eminence of its occupants, had become notably conspicuous. They resembled each other so much in their works and ways that it seems not difficult to imagine that a kind of composite portrait of Shippen, Wistar, Physick and Horner may ever mark the Chair which they in succession so admirably filled from 1765 to 1853, about eighty-seven years, before Dr. Leidy was installed.

The University of Pennsylvania appointed Dr. Leidy its delegate to the American Medical Association in 1854 at St. Louis, Mo., and in 1872 at Philadelphia, but he did not directly contribute to its Transactions at either meeting. The Committees of the Association on Medical Literature and on Medical Science cited with encomium his papers, *On the Comparative Structure of the Liver; On the Intimate Structure and History of the Articular Cartilages; On the Intermaxillary Bone in the Embryo of the Human Subject,* published in the "American Journal of the Medical Sciences," for 1848 and 1849, and *On Parasitic Life,* printed in the Proceedings of the Academy of Natural Sciences of Philadelphia.

Dr. Leidy was on the list of permanent members of the Association from 1854 to 1876. At the St. Louis meeting he was appointed Chairman of a Committee on Diseases of Parasitic Origin, and member of a Committee on Prize Essays, but no report from either has been recorded.

In 1861 he published *An Elementary Treatise on Human Anatomy,* and in 1889, the work having been out of print many years, a second edition, rewritten and enlarged. The illustrations are largely from his own drawings of many recent dissections made by him in connection with this work. A peculiar feature of the volume is that English names of the parts are given in the text, and their old Latin names in footnotes, under a belief that the subject thus presented would be more readily understood by students.

Philip Leidy, the father of the professor, died October 9, 1862, in the sixty-seventh year of his age.

In 1862, when the "Satterlee," a U. S. Army Hospital, was established in West Philadelphia, Surgeon I. I. Hayes, U. S. V., in charge, a number of leading teachers and medical practitioners of Philadelphia volunteered their services as ward physicians, and received contracts as acting assistant surgeons. To Dr. Leidy was assigned the task of conducting

the autopsies and reporting them, from time to time, to the Surgeon-General of the Army. A number of pathological specimens prepared by him accompanied his reports. They have been preserved in the Army Medical Museum in Washington. He made about sixty autopsies, of which his reports are published in "The Medical and Surgical History of the War of the Rebellion."* In this capacity he served from 1862 to 1865.

His brother, Dr. Philip Leidy, was assistant surgeon of the 106th Pennsylvania Infantry from November 1, 1861, till September, 1862, when he was appointed surgeon of the 119th Regiment of Infantry, and served in the field till he was honorably discharged, June 19, 1865. He was present in nearly all the battles of the Army of the Potomac, evincing courage and devotion to his duties "with the rare qualities of a gifted man." His official reports to the Surgeon-General are published in the history above named.

Dr. Joseph Leidy was appointed a member of the Sanitary Commission Association, April 3, 1862; and September 11, "The State of Pennsylvania, Executive Office of the Military Department at Harrisburg," appointed him Chief Surgeon within the old limits of the city of Philadelphia.

August, 1864, he married Anna, a daughter of Robert Harden, of Louisville, Ky. To compensate for the sterility of this union, they some years afterwards adopted the infant daughter of a deceased friend. Dr. Leidy told the writer that had this dear child been his own he could not have loved her more. He was fond of children. The crying or hilarious romping of the playmates of his young daughter in the study did not in the least degree disturb or divert him from his work.

Since his reports to the Surgeon-General of the Army the only paper con-



seldom adverting to its useful applications in surgery or the practice of medicine, but not merely for the sake of imparting knowledge of his subject. He carefully taught human anatomy as a means of self-maintenance. And within his domain he zealously wrought to promote the welfare of the medical department of the University, the principal source of his livelihood. This was his serious occupation, his work, which to all concerned was always acceptably done, during thirty-eight years. In all that period he was absent from his post through indisposition in the aggregate only five days.

His pastime, while not engaged in his appointed task, was somewhat different though not less laborious. To increase knowledge of natural things, animate or inanimate, gigantic or microscopic, seemed to be a ruling passion; and, like a true huntsman, he cared less for the capture than for the pleasure of pursuing his game.

It may be truly said that Dr. Leidy was born to be a naturalist. To his innate ability to perceive the minutest variations in the forms and color of things was united artistic aptitude of a high order. These natural faculties, in continuous exercise almost from his infantile days, and his love of accuracy, enabled him to detect minute differences and resemblances of all objects, and to correctly describe and portray them. Besides, nothing, however small, that came within the scope of his vision, while walking or riding, escaped his notice.

He says (p. 294) of his work on *Fresh Water Rhizopods*, 1879: "The study of natural history in the leisure of my life, since I was fourteen years of age, has been to me a constant source of happiness, and my experience of it is such that, independently of its higher merits, I warmly recommend it, than which, I believe, no other can excel it. At the same time, observing the modes of life of those around me, it has been a matter of unceasing regret that so few, so very few people give attention to intellectual pursuits of any kind."

His first important work in natural history was begun in the winter of 1844, at the instance of Mr. Amos Binney, President of the Boston Society of Natural History. It is entitled, *Special Anatomy of the Terrestrial Gasteropoda of the United States.* By Joseph Leidy, M.D., of Philadelphia. Quarto, pp. 169; illustrated by 16 plates, containing 120 figures.

This admirable essay is included in the first of the three handsome volumes of Mr. Binney's work.* In the Preface Mr. Binney says: "The author is gratified in announcing that the anatomical details of the species, together with the dissections and drawings, are exclusively due to the labors of Joseph Leidy, M.D., of Philadelphia. They constitute the most novel and important accessions to science contained in the work, and are

* *The Terrestrial Air-breathing Mollusks of the United States and the Adjacent Territories of North America;* described and illustrated. By Amos Binney. Edited by Augustus A. Gould. Charles C. Little and James Brown. Boston, 1851. Quarto, Vol. i, pp. 366, 16 plates; Vol. ii, pp. 362, 74 plates; Vol. iii, pp. 183, 57 plates.

Mr. Binney died February 15, 1847.

an honorable evidence of a skill and industry which entitle him to a high rank among philosophical zoölogists."

Dr. Leidy, in 1845, contributed three papers—anatomical descriptions of mollusks named—to the Boston Society of Natural History, which were published in its Journal and Proceedings.

On nomination by Dr. Samuel George Morton and Messrs. John S. Phillips and John Cassin, Dr. Leidy was elected a member of the Academy of Natural Sciences of Philadelphia, July 29, 1845, then at the northwest corner of Broad and Sansom streets.

At that period natural history interested comparatively few persons in the community, and by those few was regarded chiefly as a rational pastime.

A brief retrospect of the subject, which is nearly associated with Dr. Leidy's career, may be permitted to recall its ancient standing and progress in public estimation.

John Hyacinth de Magellan, of London, in 1786, gave to the American Philosophical Society (of which he was chosen a member January, 1784) two hundred guineas, to be a permanent fund, the interest thereof to be annually awarded by the Society in premiums "to the author of the best discovery or the most useful invention, relating to navigation, astronomy or natural philosophy (*mere natural history only excepted*)."*

This exception, though seemingly contemptuous, was wise. Had naturalists been eligible to receive those premiums, Dr. Leidy alone, who almost annually discovered many genera and species, might have earned the whole income of the fund. Magellan's opinion, which was probably common in his day, seems to have been that to discover and describe natural species of any kind is comparatively so easy, requires so little inventive aptitude and intellectual force, and the discovery itself import-



To rationally dispose of leisure moments; to foster peaceful study of natural things, as a wholesome diversion of the mind from the mental weariness and waste incident to idlers, quite as harmless, and more useful than contending at a game of chess; and to communicate freely to each other, as well as to the world, the results of their studies and spontaneous investigations were the chief motives which led its members to institute the Society and promote its progress.

Many books of reference, to tell students what had been already ascertained, and collections of numerous natural objects, to compare with those supposed to be new, are indispensable implements of a naturalist, but no individual was able to obtain them. Immediately after founding the Society the members saw this urgent need, and together began to form a library and a museum for their common use.

Looking forward to a time when the members of the Society would be numerous, and possibly might include zealous supporters of different religious creeds and rival political parties, the founders were somewhat apprehensive that a source of discord might arise in meetings of men holding conflicting opinions on these subjects, and for such reason agreed from the outset that, on entering the premises of the Society, every member should leave his religion and politics behind him at the door, and that debate of religious or political questions should be always out of order. This unwritten By-Law, solely designed to preserve harmony, though well understood by the members, was misconstrued outside of the Society.

Educated people, generally, then regarded the study of natural history to be in some vague way antagonistic to religion, and erroneously supposed that its votaries must be atheists or at best deists, and, therefore, to be avoided. The above unwritten By-Law, which, according to vulgar rumor, required members on joining the Society to give up religion, sustained the popular error.

During the first quarter of a century of the Academy's existence, natural history was not a part of the curriculum in any school or college in our country, because its economic value was not generally understood. Most of the Society's members were self-taught. They met in the evening once a week and before the meeting was called to order, passed some time harmoniously conversing about their studies. Their aim was to encourage spontaneous investigations and to make the Academy a practical school of natural history. No one then imagined that knowledge of it would ever become, as it is now, marketable knowledge, a part of the stock in trade of the teacher's beneficent vocation. At that time the chief incentive to the study was pure love of it, without hope of renown or emolument.

When Dr. Leidy joined the Society its library contained about 12,000 volumes, and its museum representative collections of thousands of specimens in all departments of natural history, besides chemical and other apparatus. He had at once use of all these resources, and the encouragement which flows from the fellow-feeling of many comrades working on the same line. He often said in after years that, without the facilities

found in the Academy, he could not have succeeded in many of his original researches.

Dr. Leidy was elected Librarian December, 1845. He resigned at the end of the year, and the Academy voted him thanks for his efficient service. In December, 1846, he was elected a Curator, and was continuously Chairman of the Board till he died—more than forty-four years.

During all that time he virtually directed and managed the affairs of the museum. To him it was a congenial occupation—helped him in the line of his pursuits.

At the weekly stated meetings of the Academy the Chairman of the Curators usually invited attention to any notable addition to the museum. In this connection his verbal communications, which are recorded in the Proceedings, are very numerous, and were always seemingly delivered and heard with pleasure. An examplary specimen of them is, as follows:

At a stated meeting of the Academy, October 6, 1846, Dr. Leidy announced substantially that he had lately detected an entozoon in the thigh of a hog, which "is a minute, coiled worm contained in a cyst. The cysts are numerous, white, oval in shape, of a gritty nature, and between the thirtieth and fortieth of an inch in length." He *supposed* it "to be the *Trichina spiralis* heretofore considered as peculiar to the human species. He could perceive no distinction between it and the specimens of *T. spiralis* which he had met with in several human subjects in the dissecting rooms, where it had been observed by others, since the attention of the scientific public had been directed to it by Mr. Hilton and Prof. Owen."*

In an address, delivered May 1, 1886, he said: "I recall to mind an occasion upwards of forty years ago, while I was a student assisting my preceptor, Dr. Goddard, the Demonstrator of Anatomy in the University



appearance observed in human muscles, probably depending upon the formation of very small cysticerci. By John Hilton, Demonstrator of Anatomy at Guy's Hospital."

He states substantially that Procter, aged seventy, was admitted into the hospital for a cancer, and died three months after. "Between the [muscular] fibres, and having their long axis parallel to them, are situate several oval bodies, transparent in the middle and opaque at either end, altogether about one-twenty-fifth of an inch in length. No organization could be discovered with the aid of a microscope."*

At a meeting of the Zoölogical Society of London, February 24, 1835, Mr. Owen read a description of a microscopic *Entozoon*, infesting the muscles of the human body.†

In the *Transactions of the Zoölogical Society of London*, Vol. i, pp. 315–23, is the same paper, "By Richard Owen, Assistant Conservator of the Royal College of Surgeons in London," with a plate. In that paper Mr. Owen states in substance that Mr. Paget, an intelligent student at St. Bartholomew's Hospital, observed that muscles of the body of an Italian barometer-maker, who died January 29, 1835, aged fifty, were beset with minute whitish specs," and that Mr. Paget, aided by Mr. Brown and Mr. John Bennet, at the British Museum, at the same time satisfactorily determined the existence of the entozoon.

Mr. Wormald, Demonstrator of Anatomy at St. Bartholomew's Hospital, stated that he had noticed more than once the same condition during previous anatomical seasons, and at the request of Mr. Owen, soon furnished him ample materials for microscopic examination from the subject above mentioned. Mr. Owen at once described the entozoon, which he named *Trichina spiralis*, and reported the result of his investigation to the Zoölogical Society.

Dr. Henry J. Bowditch, of Boston, was the first American who noticed the *Trichina spiralis*.‡

No one had ever suggested a source of or how this parasite found its way into the human subject until Dr. Leidy, while eating a piece of ham at his own breakfast table, discovered its existence in the hog. In announcing his discovery, with his usual caution, he said that he *supposed* it to be the *Trichina spiralis* described by Owen. This may be a reason why it was not generally recognized at the time. The publication of it in the Proceedings of the Academy was copied in full in the *Annals and Magazine of Natural History*, Vol. xix, p. 358, London, 1847; and Drs. F. Küchenmeister and F. A. Zürn state, in their work on the *Parasites of Men*, that "Leidy found, in 1847, the parasite in the muscle of pigs."‖

* *The London Medical Gazette* for February 2, 1833, Vol. xi, p. 605.

† See Proceedings Zoöl. Soc.

‡ His observations are published in the *Boston Med. and Surg. Jour.* for 1842 and 1844.

‖ Dr. T. Spencer Cobbold, a chief English authority on the subject, in his work on Entozoa, published in 1864, cites Dr. Leidy in his bibliography, but does not mention him in his text in reference to *Trichinæ*.

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The discovery that *Trichina spiralis* infests the hog is, in its economic relations, among the most important observations Dr. Leidy ever made.

Very soon after Dr. Leidy's discovery became generally known in Europe, the importation of American pork by Austria-Hungary, Germany, etc , was arrested, under a belief that American hogs are very often infested by this parasite. Recently, however, relying upon the system of inspection established by American authority, American pork is no longer excluded from European countries in which immense quantities of pork are consumed in the form of smoked meat, imperfectly cooked. Whether the Germans suppose, as has been asserted, that one pound of raw pork contains as much nourishment as a pound and a quarter well cooked, or prefer the taste of it simply smoked, is an open question. Be this as it may, it is now known that thorough cooking renders trichinous pork harmless.

Though the most ancient of lawgivers declared swine to be "unclean," unwholesome food, it does not seem supposable that he anticipated Leidy and knew that the pigs of his time were infested by this microscopic parasite.

Trichinæ found now in man, it is believed, are derived from the hog, but whence the hog receives the parasite has not been demonstrated.

Dr. Leidy was chosen a member of the American Philosophical Society October 19, 1849. Though not frequently present at its meetings, he contributed several papers to its Transactions and Proceedings.

Need of very much more space to properly accommodate the rapidly growing library and museum of the Academy had been apparent for some time, and had become so pressing that, early in 1866, measures were adopted to supply the want. Forty members were appointed a committee to solicit citizens generally to contribute to a Building Fund. Dr. Leidy was one of them, but it is believed that his modesty prevented him from actively participating in the work. A trust was created. The contributors were to elect thirteen members of the Academy Trustees of the Building Fund, with authority to purchase a site and erect thereon a suitable edifice. They represented the contributors, to whose bounty alone the Academy would be indebted for the proposed new building. When the subscriptions amounted to $100,000, the fund was placed in the custody of the Trustees.

This method of procedure was designed to remove the subject from the meetings of the Academy, and to avoid delays in construction, which, it was conjectured, might arise from officious meddling of non-contributing members, if the work were confided to a Committee of the Society.

Dr. Leidy was elected a member of the first Board of Trustees of the

See, *On Poisoning by Diseased Pork*, being an essay on trichinosis or flesh-worm disease, its prevention and cure. By Julius Althaus, M.D., M.R.C.P., London, Physician to the Royal Infirmary for Diseases of the Chest, 8vo., pp. 34. John Churchill & Sons, London, 1864.

Also, *Animal Parasites and Messmates*. By P. J. Beneden, Professor at the University of Louvain; correspondent of the Institute of France, with 83 illustrations. D. Appleton & Co., New York, 1876.

Building Fund, January, 1867, and was regularly reëlected till the close of his life. The work of the Board was not in harmony with his previous experience or taste. For this reason, perhaps, and because he unreservedly confided in the business ability of his colleagues rather than on his own, he did not warmly participate in it, though none was more desirous of its satisfactory achievement.

During his student days, and for years after graduation, Dr. Leidy was generally held to be poor; but he had already acquired a local reputation on account of his knowledge of natural history, and was regarded to be a young scientist of unusual promise. He attracted the attention of some prominent citizens, among them Dr. James Rush, to whose beneficence the city is indebted for the Ridgeway branch of the Philadelphia Library. Mrs. Rush was frequently pleased to make him a lion at her evening parties. At that time many persons were pleased to believe that he strongly resembled the conventional likeness of our Saviour. Both Dr. and Mrs. Rush were his friends and admirers during their lives.

Mrs. Rush died October 23, 1857. After that event Dr. Leidy often dined *tête-à-tête* with Dr. Rush.

Dr. Rush died May 26, 1869. Dr. Leidy was invited to be a pallbearer at the funeral, and at the same time received an intimation that he should not fail to be present. He accepted the invitation.

A few days afterwards he was greatly surprised by the receipt of a bank cheque for $500. He learned that Dr. Rush had named those friends whom he desired to be his pallbearers, and that he had instructed the executor of his estate to give $500 to each of those who served in that capacity at his funeral.

At its summer commencement of 1869, the Franklin and Marshall College, Lancaster, Pa., conferred upon him the honorary degree of *Legum Doctor*—LL.D.

In the spring of 1871 he was appointed Professor of Natural History in Swarthmore College, eleven miles from the city, in Delaware county, and lectured there at 10 o'clock A.M., at first once in the week and subsequently twice. He resigned the office in June, 1885, but continued his connection with the institution as emeritus or retired professor.

The Secretary of War invited him, May 6, 1873, to be the senior member of the scientific corps during an exploration of the route of the Pacific Railroad. This invitation was declined.

In December, 1874, he was offered the Hersey Professorship of Anatomy in the University of Harvard, at an annual salary of $4000.

He passed the summer of 1875 in Europe, visiting museums in London, Paris, Berlin, and mingling socially with renowned professors and distinguished votaries of natural science wherever he halted.

He spent the greater part of two seasons exploring the country around Fort Bridger, the Uinta mountains and Saltlake basin in search of materials for his treatise on *Fresh Water Rhizopods of North America*,

under the auspices of the U. S. Geological and Geographical Survey of the Territories, then directed by Dr. F. V. Hayden. The work was published in 1879. Dr. Leidy states, January 1, in his introduction to it, that during four years he had studied these Rhizopods as they occur in all the fresh waters of the country from the Atlantic border to an altitude of 10,000 feet in the Rocky mountains, and gratefully refers to the generous hospitality and aid received from Dr. J. Van A. Carter, formerly of Fort Bridger, who conducted his expeditions to the Uinta mountains and defrayed their expenses. Various railroad companies granted him entirely free transportation, or at half fare, so that to the Survey the expenses of this admirable work, besides the charges incident to its publication, amounted to about $222.

His friend, Mr. Joseph Wilcox, relates that while they were visiting the "bad lands" of Wyoming, he asked Dr. Leidy, "What beauties do you see in this forbidding territory?" In reply he said, "This is a most interesting place to see, where no living animal or plant exists. I enjoy the novelty of this anomalous locality. You will all agree with the man who appropriately compared this place to the infernal regions after the fires had been put out."

During many years Dr. Leidy habitually visited the Twelfth Street Market in search of specimens, and became quite intimate with Mr. R. M. Holbrook, who is a large dealer in fresh fish, etc., and is also Treasurer of the Market Company.

Speaking of Dr. Leidy, Mr. Holbrook said, "He was a man of such simplicity of manner that he drew all classes of persons to him, even children would stop and listen to him.

"At one time a few years ago he got from me a specimen of some kind of fish and wrote an article about it, in which he gave me the credit of



"He usually came to market about six o'clock in the morning before the crowd began, and sat behind the stall a half hour or more talking and watching the men while they were cleaning fish. He was always pleased to carefully examine whatever might be found in the stomachs or intestines of the larger varieties. The entrails of very big ones were sometimes sent to his house that he might inspect them at his leisure. And if anything strange came along—for whatever comes into the fisherman's net is fish—it was sent to him. Sometimes he wrote the Latin name of an uncommon kind on a scrap of paper, which my men copied in large letters and, sticking it on the specimen, displayed it on the stall. For example, on one scrap he wrote, 'Horse Crevalle—Caraux hippus. Cape Cod to the West Indies. Belongs to the Pilot-fish family and related to the Mackerels;' on another, 'Pensacola black grouper—Trisopteris microlepis;' and on a third, 'The Massachusetts Tile Fish—Monacanthus Massachusettensis.'"

The Boston Society of Natural History, January 22, 1880, "Voted that the Walker Grand Honorary Prize for 1879 be awarded to Prof. Joseph Leidy for his prolonged investigations and discoveries in zoölogy and paleontology, and in consideration of their extraordinary merit the sum awarded be $1000.*

In August, 1880, an invitation to lecture and supervise the scientific studies of the postgraduates of Princeton College, N. J., was declined.

In December, 1881, he was elected without competition President of the Academy of Natural Sciences of Philadelphia, and continuously held the office till he died.

About the year 1866 it was suggested that natural history should be taught in the University. The proposition was entertained and discussed from time to time, and lingered on without action. In 1882, under the propulsive and successful administration of Dr. William Pepper, the distinguished Provost of the University of Pennsylvania (whose policy apparently is to enlarge the institution and foster within it every branch of

* Dr. William J. Walker, a generous friend of science, who died at Newport, R. I., April 2, 1865, placed in trust of the Boston Society of Natural History means of awarding prizes for the best memoirs, written in English, on subjects proposed by a committee, appointed by the Council of the Society. The first and second prizes to be awarded annually, and the third once in five years, beginning 1870.

First.—For the best memoir presented a prize of $60 may be awarded, which sum, at the discretion of the Committee, may be increased to $100, if the memoir be of marked merit.

Second.—For the next best memoir a prize of not exceeding $50 may be awarded, provided it be of adequate merit in the opinion of the Committee.

Third.—Grand Honorary Prize. The Council of the Society may award the sum of $500 for such scientific investigation or discovery in natural history as may be deserving thereof in its judgment, provided such investigation or discovery shall have first been made known and published in the United States of America; and at the time of said award shall have been made known and published at least one year. "If in consequence of the extraordinary merit of such investigation or discovery, the Council of the Society should see fit, they may award therefor the sum of $1000." *Proc. Boston Soc. Nat. Hist.*, Vol. x, p. 146, 1866.

human knowledge which may be profitably taught), a school of natural history was devised and instituted under the modern style of Department of Biology, and Dr. Leidy was appointed, for the current academic year, Professor of Biology (Zoölogy) in the Faculty of Philosophy.

In 1884 the department was organized by the appointment of a Faculty of seven professors, including Dr. Leidy as Professor of Zoölogy and Comparative Anatomy, and he was elected, May 6, Director of the Biological Department.*

It was proposed, March 16, 1885, that his salary should be $6000, on condition that he should resign his position in Swarthmore College, which he did, and give his time exclusively to the University.

A laboratory, an herbarium and an appropriate museum were started. To the latter Dr. Leidy contributed many of his skillfully made preparations, and bequeathed to it an herbarium of about 1400 species of plants, collected by himself.

In this connection the University Marine Biological Association has been founded, with laboratories and aquaria located at Sea Isle City, N. J.

The Geological Society—Burlington House, London, January 5, 1884—awarded to Dr. Leidy the Lyell Medal, with its accompanying purse of £25, in recognition of his important services to paleontology.

About the close of the year 1883 the attention of Dr. Leidy was invited to a subject which he had not previously considered.

Mr. Henry Seybert, a firm believer in modern spiritualism, who died March 3, 1883, aged eighty-two years, not long before his death gave to the University of Pennsylvania a sum of money sufficient to found a Professorship of Philosophy, on condition that the University should appoint a commission to investigate "all systems of morals, religion or philosophy, which assume to represent the truth, and particularly of modern spiritualism."

Ten gentlemen, most of them members of Faculties or of the Board of Trustees of the University, were constituted a commission to investigate modern spiritualism. Dr. Leidy, with one or more members of the commission, attended twelve sittings with reputed spiritualist mediums, from March, 1884, to April, 1887. The commission submitted a preliminary report of its proceedings May, 1887.†

The Trustees of the Wagner Free Institute of Science elected him, July 27, 1885, President of the Faculty and Professor of Biology, at an annual salary of $500. From that date the Trustees obtained his views before deciding any question relating to the scientific policy of the Institute, and appointed members of the Faculty subject to his approval. He lectured two or three times every season, and always attracted a large audience. In the spring of 1890, lectureships superseded the Faculty system, and

* University of Pennsylvania. Handbook of Information, concerning the School of Biology, Philadelphia, 1889.

† Preliminary Report of the Commission appointed by the University of Pennsylvania to Investigate Modern Spiritualism, in accordance with the Request of the late Henry Seybert, 12mo, pp. 160. J. B. Lippincott Company, Philadelphia, 1887.

Dr. Leidy was elected Director of the Museum June 3, 1890, and spent some of his last days in planning a synoptical arrangement of it.

He was authorized by the Trustees to expend $3000, while in Europe in 1889, in the purchase of specimens for the museum, and on his return $1000 more were placed in his hands to be spent in the United States for objects of the same kind. His interest in the growth of the museum and library was constant. He presented many books and specimens collected by himself.

At its summer commencement of 1886, Harvard University conferred upon him its honorary degree of *Legum Doctor*—LL.D.; and the Institute of France awarded to him, December 18, 1888, the Cuvier prize medal.

He had now reached the sixty-fifth year of his age. Unremitting routine and other labors, and the enjoyment of many social meetings with friends, had somewhat abated both his physical and mental energies. Rest was desirable. Accompanied by his wife and daughter he visited Europe in the summer of 1889, but his first letters from London indicate that the sojourn there was much less cheering to him than it ever had been. And then the serious illness of Mrs. Leidy, soon after reaching England, greatly augmented his depression, although the sympathy and attention of his English friends were unstinted. After her recovery the projected tour was completed, and in September all returned in better health and spirits than when they started on their trip to Europe.

Soon after reaching home a rumor from the University was a source of much distress to Dr. Leidy. It was said that the professorships were to be rearranged, and to realize the plan he would be asked to relinquish the Chair of Anatomy and retain his position in the Biological Department. A city newspaper reported substantially that Dr. Leidy had been requested to resign. The statement was at once authoritatively contradicted. Nevertheless, subsequently he, who was pronounced by one of the Faculty to be the "most consummate teacher that ever held the Chair of Anatomy," was requested to relinquish it, but he declined.

During the year 1890, in compliance with the wish of a valued friend, he visited several times the establishment of Mr. Keely, who claims that he had long ago discovered a new motor of extraordinary force. Diligent study during many years has failed to ascertain a practical method of applying this power to any use. With this aim Mr. Keely has constructed costly and ingenious machinery which is set in motion by this occult power. Many prominent scientists, engineers and others have been invited at different times to inspect it, hoping probably that their opinions would encourage his continuous research. It seems, however—if the public be rightly informed in the premises—that, in their judgment, the nature of this new force, whatever it may be in fact, is *not* yet apparent. But Dr. Leidy wrote, December 18, on his card to a friend, "Keely appeared to me to have *command of some power previously unknown.*"

This statement is not even presumptive testimony that a previously unknown natural force is now under command. Unsurpassed ability to ascertain the structure of organisms of every kind, as Dr. Leidy had, is not in itself sufficient to guarantee that the witness may not be deceived as to the motive force that operates complicated machinery, especially one who has never been interested in or studied any branch of physics. The judgment of a backwoodsman on the sea-worthiness and fighting qualities of the first battleship he ever visited would be as respectable.

His membership in many societies at home and abroad is significant of his widespread reputation. A list of them is appended.

Prof. Henry C. Chapman, of Jefferson Medical College, in his Memoir, printed in the Proceedings of the Academy of Natural Sciences of Philadelphia, for 1891, has noticed in a summary but admirable manner each of Dr. Leidy's leading publications. Lists of all of them may be found in the Appendix.

The general character of all his works is anatomical. They consist almost entirely of technical descriptions of genera and species of existing or extinct animals. Though highly creditable to their author, they interest very few persons besides votaries of natural history, because they are not applicable to any apparent industrial use. Such writing does not bring pecuniary reward. With the exception of his books on Anatomy and reports to the Surgeon-General of the Army, he received no substantial compensation for any of his numerous essays.

Inasmuch as botany and mineralogy were greatly preferred to other branches of natural history in his early life, it is notable that he published little, if anything of importance, in connection with either.

Prof. Thomas C. Porter, of Lafayette College, among the foremost of our botanists, who was his intimate friend during many years, wrote in reply to inquiries: "To your other question I can give a definite answer. Of course, as a master of biology, he had a comprehensive knowledge of [illegible]ical botany, but his interest in the plant world [illegible]quaintance with our native [illegible] of great

acquainted with the region about us. Suddenly Dr. Leidy said, raising his hands, 'Dear me! there is a plant which Gray says only grows high on the mountains, and here it is by the sea.' He gathered a portion of it with great care and put it in his pocket. When he got to the house he spoke of his find, and showed Mrs. —— the specimen. 'Why, Doctor,' she said, 'that is *Empetrum*.' The doctor looked carefully at it and said, 'Why, so it is; I thought it was *Loiseleuria*,' and laughed heartily, receiving the correction as though it had come from Gray himself."*

His deep interest in mineralogy was continuous from boyhood till the close of his life. To him it was a kind of Sunday afternoon or holiday recreation to visit friends who had cabinets, examine their newly acquired specimens, and talk about them in connection with those in rival collections. Always seeking to obtain rare specimens, especially of gems, he bought and sold and exchanged minerals with his friends whenever opportunity occurred. About the year 1870 he purchased a collection, said to be the finest ever brought from Europe to this country, and a year or two after sold it to a party in Boston for $2000, because he said he could not afford to keep it. He continually added to and improved his cabinet, which, at his death, was sold to the National Museum at Washington, D. C., for $2800.

He was not practically interested in the chemical analysis of minerals. But through his life-long habit of examining, comparing and exchanging specimens, as well as of buying and selling them, he acquired the skill of an average lapidary in recognizing mineral forms, especially of gems, and among his friends became an authority for their market value. Yet more than once he mistook an artificial for a real stone, submitted to his inspection by a dealer to test his knowledge.

Dr. Leidy had a broad chest and strong limbs, was about five feet ten or eleven inches in height and 200 pounds in weight. Relatively to his stature, slightly stooping at the shoulders, his head was rather small; and it was ascertained after death that his brain weighed forty-five and a half ounces—somewhat less than the average. But deficiency of brain tissue was probably compensated for by the sustaining power of good blood-circulating and digestive apparatus, upon the normal functions of which mental activity in a degree depends. It is commonly known that a drink of tea or of any stimulant temporarily augments the activity of the mental machinery when it is moving slowly from fatigue or other cause. It is generally supposed, however, that intellectual energy is in proportion to the size of the brain, the prevailing weight of which in adult man is from forty-six to fifty-three ounces, according to an English authority,† and from forty-five to fifty-five ounces among our own people, and among all races from two to four pounds, according to an American authority.‡

* In Memoriam. Dr. Joseph Leidy, b. Sept. 9, 1823, d. April 30, 1891. Personal History. By William Hunt, M.D. Read at the Academy of Natural Sciences, May 12, 1891.

† *Anatomy, Descriptive and Surgical.* By Henry Gray, F.R.S.

‡ *An Elementary Treatise on Human Anatomy.* By Joseph Leidy, M.D., LL.D., etc. Second edition, 1889.

PROC. AMER. PHILOS. SOC. XXX. 138. U. PRINTED APRIL 23, 1892.

"A little man with the same size of head as a big man will (other things being equal) possess more energy. In weight of brain, again, considerable differences exist among men of acknowledged power. The average weight of the male brain in civilized races is about 49 ounces. Cuvier's brain weighed 64 ounces; Abercrombie's and Schiller's, 63; De Morgan and Gauss, the mathematicians, 52¾ and 52 respectively. But Grote, the historian, had a brain only three-quarters of an ounce above the average, while the brains of Tiedemann, the anatomist, and Hausmann, the mineralogist, fell 5 and 6 ounces below it. * * *

"The heaviest known human brain belonged to a Sussex bricklayer, who died of consumption in University College Hospital in 1849. It exceeded 67 ounces and was well proportioned; while in physical size its owner was not greatly above the average, being 5 feet 9 inches in height and of robust frame. But the man could not read or write, though he was said to have a good memory and to be fond of politics."*

According to these data size or weight of brain is not a measure of mental capability.

Dr. Leidy had a handsome forehead, though it was not remarkably high nor broad. Compared with the head, his face was perhaps large. Nearly horizontal, straight brows slightly overhung tranquilly pensive blue eyes, which were not widely separated by a full-sized, well-formed nose. His mouth, slightly drooping at the corners, contained a set of fine teeth. The lips were well proportioned and his chin was broad. He wore a full beard and was well crowned with fine hair. While conversing with friends the expression of his face was truly significant of his very amiable disposition. His utterance was distinct and the tone of his voice pursuasive and pleasant, though slightly nasal. A natural and very modest demeanor made him welcome wherever he was. He loved the company of his



the opinion of some of his warmest friends, and caused them on occasions to jocosely say: "Oh! he is an invertebrate."

While he was a bachelor his manner of living was properly economical, and his savings at different times amounted to considerable sums; but his financiering ability or forecast seemed to be limited to this kind of hoarding. At the time when speculation in petroleum was imagined to be a sure road to fortune, he listened to a friend supposed to be knowing in the field, invested in a petroleum company and lost $4000. On another occasion he was lured by promises to invest in a silver mine and lost about twice as much. Next he purchased stock of a certain railroad which from that day never made a dividend, and sold it for about half its cost.

During the first half of his life or more his attention was exclusively given to anatomical and natural history pursuits. General literature or popular diversions did not interest him in any considerable degree. His diary kept while in Europe in 1848 mentions that he once attended the Haymarket Theatre in London, and that he passed one evening in Paris at the Theatre du Palais Royal. But galleries of paintings and sculpture attracted his attention. To a friend who presented him a poem years ago he said: "I never read poetry. It seems to me such a round-abound way of expressing ideas." And to another he said he did not understand how anybody could read "rhyming stuff." But in the last decade of life, when age and experience had tamed his energies, and egoism was less exacting, his tastes changed. He read with pleasure certain poetic compositions, which friends commended, and now and then a novel. Theatrical amusement often attracted him, and he was sometimes pleased to hear the music of his daughter's piano in the parlor while he was engaged in his study. He daily read newspapers, and, as a good citizen, voted at elections of city, State and United States officers.

In some respects he resembled Charles Darwin. Matthew Arnold says: "Mr. Darwin once owned to a friend that, for his part, he did not experience the necessity of two things, which most men find so necessary to them—religion and poetry; science and the domestic affections he thought were enough."*

In his autobiography Mr. Darwin says: "For many years I cannot endure to read a line of poetry; I have tried lately to read Shakespeare, and have found it so intolerably dull that it nauseated me. I have almost lost my taste for pictures and music. * * * My mind seems to have become a kind of machine for grinding general laws out of a large collection of facts."

Dr. Leidy, however, sought chiefly to ascertain facts; he did not attempt to deduce general laws from them.

He accepted, without reserve, all the theories of evolution, etc., of Mr. Darwin, with whom he had correspondence, but their religious views were very different.

* *Discourses in America.* By Matthew Arnold. Macmillan & Co., London, 1885, p. 113.

In a letter, dated February 28, 1879, addressed to his friend, the Rev. Dr. Henry C. McCook, he said: "I mark what you say in reference to quoting from the *Cosmic Philosophy* of Prof. Fiske, instead of expressing my opinions in my own language. I preferred doing so because my religious views so fully accord with those he so clearly presents to the reader. I have always had an antipathy to enter into a discussion of religious opinions, and when persons, curious to know mine, have questioned me, to avoid discussion, I have the last few years referred them to the admirable work of John Fiske.

"While I am disposed to avoid public notice, I feel some recompense in your having read my note to your audience, as it may tend to remove the reproach of atheism, which you know is so unreasonably and freely imputed to all naturalists and philosophers.

"Through life I have been conscious of having been a devoted worshiper (again to quote Mr. Fiske) 'of an ever-present God, without whom not a sparrow falls to the ground;' and I have often felt annoyed at the implied reproach of infidelity from the self-sufficient who consider that they fulfill all religious duty in lip-service to the same Deity."

Though not a regular attendant of any church, he was pleased to listen occasionally to sermons of the Rev. Drs. Phillips Brooks (Episcopalian), Ed. R. Beadle (Presbyterian) and William H. Furness (Unitarian). The teaching of the last was in accordance with his own religious views.

The genius of Dr. Leidy—an innate force that seems to dominate the exercise of the natural aptitudes or talents—a force none of his ancestors possessed, and is therefore not ascribable to heredity—impelled him to investigate natural objects and portray those which had not been previously described. His strong egoism was more gratified in this occupation than in any other. Some of his contemporaries, who wrought in the same



Announcement of his death brought expressions of regret for the loss sustained and of admiration of his character from many citizens. Newspapers published sketches of his career and praised his works and ways.

The Alumni Society of the Medical Department of the University of Pennsylvania held its annual meeting in the evening of the same day. The President, Dr. Alfred Stillé, officially announced that Dr. Leidy had died in the morning, and said, among other things, that by the death of Dr. Leidy the University "looses the profoundest and most consummate teacher that ever held the Chair of Anatomy, and whose fame as a comparative anatomist, paleontologist, geologist, zoölogist and botanist was not bounded by his native city or country, but was coextensive with the civilized world.

"No man, who had such reason to be proud, was ever more humble. His simple and amiable manners attached to him the old as well as the young, and made him revered in the gravest circles of the learned and loved by the students, whom he inspired by his example and enriched by his knowledge."

The Wagner Free Institute of Science recorded its sense of loss in a minute, as follows:

"With feelings of deep sorrow we record the death of Dr. Joseph Leidy, who, for the past six years has stood at the head of the science work of our Institute as President of the Faculty and Director of the Museum.

"The death of this true and honest man, as gentle as he was strong, as humble as he was great, is to the whole civilized world, as it is to our own country, the loss of one of the most distinguished scientists of the day; while to Philadelphia, the city of his birth and life-long home, it is the loss, not only of one of her greatest men, but as well of a true and faithful son, who loyally spent his whole life in her service, and who died, as he lived, in entire devotion to duty, wholly forgetful of himself, and mindful of the welfare of others.

"To the Wagner Free Institute of Science the loss occasioned by his death is beyond repair. The place he has left vacant cannot be filled. To him, more than any other man, and to his good guidance more than anything else, is due whatever has been accomplished by the Institute since the death of its founder, in the organization and conduct of its work in the cause of science. It is impossible to express in words the debt of gratitude we owe to him; only by deeds can we give expression to it, by striving to carry out the work which he has planned for us with such consummate skill, that it may become a living memorial of his earnest labors, his broad intelligence and his commanding knowledge."

And in the first paragraph of his Valedictory Address to the graduating classes in medicine and dentistry of the University, delivered at the annual commencement, May 1, 1891, Prof. James Tyson said: "The ink was scarcely dry on my page when came the intelligence that Joseph Leidy was seriously ill, and close on this fact of his death. This most

unexpected calamity has changed the present occasion from one of rejoicing to one of mourning—scarcely mitigated by the circumstance that Dr. Leidy died as he wished, after a short illness and with his shoulder, as it were, still at the wheel. For Dr. Leidy never ceased to work. His industry was only equaled by his intellect, and these by the sweet simplicity of his life. He loved science for science's sake, and neither poverty nor promise of riches, nor ambition, nor princely decoration could swerve him from his purpose. We are stupefied by the suddenness of our loss. And there is a fitness in the association of the end of your greatest teacher's life, and the new commencement of your own, which ought not to be without its effect in keeping green his precious memory, and in stimulating you to emulate his example."

The funeral services were at the First Unitarian Church, May 2. Members of the societies to which he belonged, the Faculties of the University, and prominent citizens in large numbers were present. The venerable and Rev. Dr. Furness officiated, and delivered an eloquent and touching tribute to his worth.

His remains, and at the same time those of his brother, Dr. Philip Leidy, who died April 29, were cremated, May 9.

Not long afterwards representatives of the University solicited contributions to an endowment of $50,000 to be raised at once and exclusively devoted to the use of his widow; and ultimately revert to the University, "to establish and endow the *Leidy Memorial Museum* as an independent part of the great museum" projected for the Institution. Dr. Leidy bequeathed a modest sufficiency for his family. For such reason, probably, the necessity of the proposed endowment was not generally regarded to be urgent. About the same time it was decided to obtain an endowment for the Chair of Anatomy, the sum to be counted in the General Endow-



He also said, in substance, that while Cope and Marsh were working the fossiliferous field into which Dr. Leidy had entered long before, and by his labor made, in a sense, his own, they fell into disputes over priority of dates of different names of genera and species found in the later strata of a Western Territory, in which contention Leidy, the friend of both, refused to take any part. And, it seems proper to add, so dominant was his repugnance to controversy of every kind that he left his friends, freed from his participation, to compete with each other, and for a considerable period engaged in an entirely different field of investigation, to return long afterwards to his beloved paleontology.

The Trustees of the Building Fund of the Academy of Natural Sciences ordered, May 15, 1891, a memorial notice to be preserved with the record of their proceedings, in which it is stated that "his modest, amiable deportment at all times, his abiding interest in the welfare of the Academy and in the progress of the natural sciences, won for him the unreserved confidence and respect of his colleagues on the Board, and made his presence at its meetings always welcome. But his connection with the Trustees and his many official positions in the Academy could not add to the high estimation in which he was held in the community. His accurate and extensive knowledge of natural history in all its departments, his writings, his most acceptable teachings as Professor of Natural History in Swarthmore College, and as Professor of Human Anatomy in the University of Pennsylvania during more than a third of a century, from May, 1853, obtained for him a deserved reputation and fame among the friends of the Natural Sciences at home and abroad."

In his *Address to the Graduating Class of 1891, at Swarthmore College*, June 16, the President of the Board of Managers, Mr. Joseph Wharton, said: "And since nothing more potently aids us in the struggle to become wiser and better than observation of those who stand above us, and study of their methods, I can do nothing more fitting this occasion than endeavor to show you how this great man came to be so eminent, so trusted and so beloved.

"Joseph Leidy inherited excellent constitution of mind and body; he was transparently sincere and absolutely devoted to truth; he was remarkably devoid of selfishness in any form; he had persistent and lifelong diligence; he was systematic in his expenditure and careful in his economy of time; he held firmly to whatever task he undertook; his temper was cheerfully equable and his disposition affectionate."

Commenting on each of these characteristics successively, in a lucid style, Mr. Wharton thus happily concludes his pleasing address: "If now I have succeeded in showing you that every part of Dr. Leidy's great eminence grew out of the cultivation of such natural powers as your own, and out of the constant practice of such simple virtues as should also be yours, that, in a word, you may hope to scale such heights, to breathe such lofty air, to serve so well your kind, and to attain such universal respect and affection, without possessing other genius than that which has

DR. LEIDY'S MEDICAL PAPERS AND BOOKS.

The Medical Journal of the Medical Sciences:

On Several Important Points in the Anatomy of the Human Larynx. Vol. 12, pp. 141–43, 1846.

Researches into the Comparative Structure of the Liver. Vol. 15, pp. 13-25, 3 plates, Jan., 1848.

On the Intimate Structure and History of the Articular Cartilages. Vol. 17, pp. 277–94, 2 plates, April, 1849.

Intermaxillary Bone in the Embryo of the Human Subject. Vol. 17, p. 577, 1849. Also reported Jan. 9, 1849, in Proc. Acad. Nat. Sci., Vol. 4, pp. 145–47.

Notice of Certain Bodies observed in the Human Subject. Vol. 20, pp. 89-91, 1850.

Human Anatomy. By James Quain, M.D. Edited by Richard Quain, F.R.S., and William Sharpey, M.D., F.R.S., Professor of Anatomy and Physiology in University College, London. First American from the Fifth London Edition. Edited by Joseph Leidy, M.D. In 2 Vols., with over 500 illustrations. Lea & Blanchard, Philadelphia, 1849.

Atlas of Pathological Histology. By Gottlieb Gluge, Professor of Physiology and Pathological Anatomy in the University of Bruxelles; Member of the Royal Academy of Bruxelles. Translated from the German by Joseph Leidy, M.D., Pathologist to St. Joseph's Hospital, Philadelphia; Fellow of the College of Physicians of Philadelphia; Honorary Fellow of the Medical Society of Virginia; Corresponding Member of the Biological Society of Paris, etc. With 320 figures, plain and colored, on 12 copperplate engravings. Folio, pp. 100. Blanchard & Lea, Philadelphia, 1853.

The Medical and Surgical History of the War of the Rebellion. Quarto. Part i, Vol. 2, 1870. *Surgical History:*

Report of Case of Gunshot Wound of the Cervical Vertebræ, with Autopsy and Specimen. p. 431, 1863.

Gunshot Wound of Rib, with Autopsy and Specimen. p. 569.

Part ii, Vol. 2, 1876. *Surgical History:*

Gunshot Flesh Wound, with Autopsy. p. 439.

Excision of Humerus necrosed after Gunshot Wound, with Autopsy. p. 596.

Gunshot Wound of Forearm, with Autopsy and Specimen. p. 927.

Specimen of Ulna successfully excised on Account of Gunshot Wound, with Report of the Case. p. 962.

Part ii, Vol. 1, 1879. *Medical History:*

Reports of Cases and Autopsies made from July 30, 1862, to Oct. 25, 1864. pp. 109–122; and subsequently p. 300, p. 518 and p. 581.

NOTE.—Dr. J. Leidy's official communications to Surgeon-General Barnes embrace reports of more than sixty autopsies and cases.

An Elementary Treatise on Human Anatomy. By Joseph Leidy, M.D., Professor of Anatomy in the University of Pennsylvania; Curator of the Academy of Natural Sciences; Member of the American Philosophical Society, American Academy of Arts and Sciences, Natural History Society, Boston, Lyceum of Natural History, New York, Elliot Natural History Society, Charleston, S. C., Medical Society of Virginia, Academy of Sciences of St. Louis, Imperial Society of Moscow, Royal Academy of Sciences, Munich, Imperial Leopold Carol. Academy of Sciences of Jena, Biological Society of Paris, Society of Arts and Sciences, Mons, Zoölogical Society, London, United Zoölogical and Botanical Association, Berlin, etc. With 392 illustrations. J. B. Lippincott & Co., Philadelphia, 1861.

Intestinal Worms. 8vo, pp. 930-954 incl., in Vol. 2 of A System of Practical Medicine. By American Authors. Edited by William Pepper, M.D., LL.D., etc.; assisted by Louis Starr, M.D., etc. Lea, Brothers & Co., Philadelphia, 1888.

An Elementary Treatise on Human Anatomy. By Joseph Leidy, M.D., LL.D., Professor of Human and Comparative Anatomy and Zoölogy in the University of Pennsylvania; President of the Academy of Natural Sciences, and of the Faculty of the Wagner Free Institute of Science. Second Edition, rewritten, with 495 illustrations. 8vo, pp. 950. J. B. Lippincott Company, Philadelphia, 1889.

DR. LEIDY'S BOOKS AND PAPERS ON NATURAL HISTORY.

Anatomical Description of the Animal of Littorina angulifera. Illustrated. [Presented July 16, 1845.] Boston Journal of Natural History, Vol. 5, pp. 314–17. Boston, 1847.

On the Anatomy of the Animal of Helix albolabris, Say. Illustrated. Proceedings of the Boston Soc. Nat. Hist., Vol. 2, p. 57, 1845.

On the Sack of the Dart, and of the Dart in Several Species of American Pneumobranchiate Mollusks. Proc. Boston Soc. Nat. Hist., Vol. 2, pp. 59–60, 1845.

A Notice of Helix lithophaga, p. 207, Official Report of the United States Expedition to Explore the Dead Sea and River Jordan. By Lieut. W. F. Lynch, U.S.N. Published at the National Observatory, Washington. Quarto, printed in Baltimore, 1852.

DR. LEIDY'S PAPERS PUBLISHED IN THE PROCEEDINGS OF THE AMER. PHILOS. SOC.
Octavo.

Verbal Remarks, March 4, 1859, on the Geology of the Headwaters of the Missouri. Vol. 7, p. 10.

A Biographical Notice of Isaac Lea, LL.D. Read Nov. 18, 1887. Vol. 14, pp. 400–8.

DR. LEIDY'S PAPERS PUBLISHED IN THE TRANSACTIONS OF THE AMER. PHILOS. SOC.

Vol. 10, New Series, Quarto, Published 1853:

On the Organization of the Genus Gregarina of Dufour. Read Jan. 3, 1851, pp. 233–40, 2 plates.

Some Observations on Nematoidea imperfecta, and Description of Three Parasitic Infusoria. pp. 241–44, 1 plate.

Description of an Extinct Species of American Lion. Read May 7, 1852, pp. 319–24, 1 plate.

A Memoir on the Extinct Dicotylina of North America. Read May 21, 1852, pp. 328–43, 4 plates.

In Vol. 11, New Series, Quarto, 1860:

Notice of the Remains of the Walrus discovered on the Coast of the United States. pp. 83–86.

Descriptions of the Remains of Fishes from the Carboniferous Limestone of Illinois and Missouri. Read July 15, 1856, pp. 87–90.

Saurocephalus and its Allies. Read Nov. 21, 1856, pp. 90–95.

Observations on the Extinct Peccary of North America; being a Sequel to a Memoir on the Extinct Dicotylinæ of America. Read Nov. 21, 1856, pp. 96–105.

Extinct Vertebrata from Judith River and Great Lignite Formations of Nebraska. pp. 139–54, plate.

UNITED STATES GEOLOGICAL SURVEY OF THE TERRITORIES.

Description of the Remains of Extinct Mammalia and Chelonia from Nebraska Territory, collected during the Geological Survey under the Direction of Dr. David Dale Owen. By Joseph Leidy, M.D., of Philadelphia. Quarto. Pp. 540–72 of the Report of the Geological Survey of Wisconsin, Iowa and Minnesota. By D. D. Owen, under instructions of the U. S. Treasury Department. Lippincott, Grambo & Co., Philadelphia, 1852.

Contributions to the Extinct Vertebrate Fauna of the Western Territories. By Prof. Joseph Leidy. Quarto, pp. 358, 37 plates. Being Vol. 1 of the Report of the United States Geological Survey of the Territories. By F. V. Hayden, United States Geologist in Charge. In Five Volumes. Government Printing Press, Washington, 1873.

Freshwater Rhizopods of North America. By Joseph Leidy, M.D., Professor of Anatomy in the University of Pennsylvania, and of Natural History in Swarthmore College, Pennsylvania. Government Printing Office, Washington, 1879. Quarto, pp. 324+48 =372. Illustrated by six figures intercalated in the text, and 48 plates which contain 1180 figures of 31 genera and 84 species, of which Dr. Leidy originally described 52 species. All the figures were first drawn and colored by Dr. Leidy, to be copied by artists.

JOURNAL OF THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA.
Second Series. Quarto.

1. History and Anatomy of the Hemipterous Genus Belostoma. 2. Miscellanea Zoölogica. Vol. 1, pp. 5.–67 and 67-70, 1 plate, 1847.

Descriptions of two species of Distoma, with the partial history of one of them. Vol. 1, pp. 301-309, 1 plate, 1850.

Descriptions of Some American Annelida abranchia. Vol. 2, pp. 43–50, 1 plate, 1850.

Description of a New Species of Crocodile from the Miocene of Virginia. Vol. 2, pp. 135–8, 1 plate, printed Dec. 1851.

On the Osteology of the Head of Hippopotamus, and a Description of the Osteological Characters of a New Genus of Hippopotamidæ. Vol. 2, pp. 207–24, 1 plate, 1853.

On Bathygnathus borealis, an Extinct Saurian of the New Red Sandstone of Prince Edward's Island. Vol. 2, pp. 327-30, 1 plate, 1854.

Contributions towards a Knowledge of the Marine Invertebrate Fauna of the Coasts of Rhode Island and New Jersey. Vol. 3, pp. 135–152, 2 plates, 1855.

Descriptions of Some Remains of Fishes from the Carboniferous and Devonian Formations of the United States. Vol. 3, pp. 159–65, 1 plate, 1856.

Descriptions of Some Extinct Mammalia. Vol. 3, pp. 166–71, 2 plates, 1856.

The Extinct Mammalian Fauna of Dakota and Nebraska. Including an Account of Some Allied Forms from Other Localities, together with a Synopsis of the Mammalian Remains of North America. Illustrated with 30 plates. Preceded with an Introduction on the Geology of the Tertiary Formations of Dakota and Nebraska, accompanied with a Map. By F. V. Hayden, M.D., Professor of Mineralogy and Geology in the Univ. of Pa., U. S. Geologist, etc., etc. Vol. 7, pp. 472, 1869.

NOTE.—The authors of the above-named work were enabled to execute it chiefly through the generosity of Messrs. Joseph Jeanes and William P. Wilstach, to whom, as well as to some others, they acknowledge indebtedness.

Description of Vertebrate Remains chiefly from the Phosphate Beds of South Carolina. Vol. 8, pp. 209–61, 5 plates, 1874–81.

Parasites of the Termites. Vol. 8, pp. 425–47, 2 plates, 1874–81.

Remarks on Bathygnathus borealis. Vol. 8, pp. 449-51.

Urnatella gracilis, a Fresh-water Polyzoan. Vol. 9, pp. 5–16, 1 plate, 1884.

SMITHSONIAN CONTRIBUTIONS TO KNOWLEDGE.
Quarto.

A Flora and Fauna within Living Animals. (Accepted for publication 1851.) Vol. 5, pp. 68, 10 plates, 1853.

Memoir on the Extinct Species of Fossil Ox. (Accepted for publication 1852.) Vol. 5, pp. 20, 5 plates, 1853.

The Ancient Fauna of Nebraska; or a Description of Extinct Mammalia and Chelonia from the Mauvaises terres of Nebraska. (Accepted for publication 1852.) Vol. 6, pp. 126, 25 plates, 1854.

A Memoir on the Extinct Sloth Tribe of North America. (Accepted for publication Dec., 1853; published June, 1855.) Vol. 7, 1855, pp. 70, 16 plates.

retaceous Reptiles of the United States. (Accepted for publication Dec., 1864.) Vol. 14, 1865, pp. 140, 20 plates.

ANNUAL REPORTS OF THE BOARD OF REGENTS OF THE SMITHSONIAN INSTITUTION.

Brief Review of a Memoir on the Cretaceous Reptiles of the United States, published in the Fourteenth Volume of the Smithsonian Contributions to Knowledge. By the Author, Joseph Leidy, M.D. 8vo, pp. 66-73. For the year 1864. Washington, D. C., 1865.

WRITTEN AND VERBAL COMMUNICATIONS BY DR. JOSEPH LEIDY PUBLISHED IN THE PROCEEDINGS OF THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA.

1845.

Notes taken on a Visit to White Pond, Warren Co., N. J., and a List of Ten Species of Fossil Shells collected there. Vol. 2, p. 279.

Verbal, Nov. 18, That his microscopic observation of a portion of a vertebra of the Fossil Zeuglodon shows that it has all the characteristics of recent bone. Vol. 2, p. 292.

1846.

Remarks on the Anatomy of the Abdominal Viscera of the Sloth, Bradypus tridactylis. Vol. 3, pp. 72-4, 2 figures.

On the Anatomy of Spectrum femoratum, Say. Vol. 3, pp. 80-4. Illustrated by 18 figures on 2 plates.

On the mechanism which closes the membranous wings of the genus Locusta. Vol. 3, p. 104, 1 fig.

Descriptions of a new genus and species of Entozoön, Cryptobia helicis. Vol. 3, p. 100, 1 fig. [Finding that this name, Cryptobia, had been previously appropriated he changed it, August, 1847, to Cryptoicus.]

Verbal, Oct. 6, notice that he had lately detected an Entozoön [*Trichina spiralis*] in the superficial part of the extensor muscle of the thigh of a hog. Vol. 3, pp. 107-8.

On the Situation of the Olfactory Sense in the Terrestrial Tribe of Gasteropodous Mollusca. Vol. 3, pp. 136-7.

Verbal, April 15, remarks on the great fecundity of the Cryptogamia indicated in a specimen Puffball. Vol. 3, p. 195.

1847.

Verbal, May 4, statement that he has observed numerous octagonal crystals, supposed to be oxalate of lime, in the cellular structure of several species of Parmelia. Vol. 3, p. 210.

Verbal, June 8, notice of the remains of sutures of the incisive bone distinctly traceable in the cranium of a New Hollander, then exhibited. Vol. 3, p. 217.

Verbal, June 22, description of Distoma helicis, an Entozoön found in the pericardium of Helix alternata. Vol. 3, p. 220.

Verbal, Aug. 24, remarks on the teeth of the specimen of Squatina Dumerli exhibited. Vol. 3, p. 247.

Description and Anatomy of a New and Curious Subgenus Planaria. Vol. 3, pp. 248-51.

Description of two new species of Planaria. Vol. 3, pp. 251-2.

On the Fossil Horse of America. Vol. 3, p. 262, 1 plate, 6 figs.

Verbal, Nov. 9, remarks on the slow destructibility of Animal Tissues in certain states. Vol. 3, p. 313.

On a new genus and species of Ruminantia, Poebrotherium Wilsonii. Vol. 3, pp. 322-6, 1 plate, 6 figs.

Verbal, Dec. 14, observations, in addition, on the Fossil Horse. Vol. 3, p. 328.

1848.

Verbal, Jan. 11, notice that he had found an eye in Balanus rugosus, heretofore admitted to exist only in the larva or imperfect stage of the Cirrhopoda. Vol. 4, p. 1.

Verbal, Feb. 15, notice of the Hair of a Hottentot boy. Vol. 4, p. 7.

On some Peculiar Bodies in the Boa constrictor, resembling Pacinian Bodies. Vol. 4, pp. 27-8, 4 figs.

A new fossil genus and species of ruminatoid pachydermata, Merycoidodon Culbertsonii. Vol. 4, pp. 47–50, 5 figs.

Verbal, Dec. 5, remarks on the development of the Purkenjean Corpuscle in bone; the intimate structure of cartilage, and on the arrangement of the areolar sheath of muscular fasciculi and its relations to the tendon. Vol. 4, pp. 116–20.

1849.

Verbal, Jan. 9, remarks on the existence of the intermaxillary bone in the embryo of the human subject. Vol. 4, pp. 145–7, 2 figs.

Remarks on fragments of the fossil Tapir deposited in the Academy. Vol. 4, pp. 180–2.

Remarks on species of Confervaceæ; on a new genus of Enterobrus elegans; Cladophytum; a new genus of Entophyta; Cladophytum somatum; Anthromitus (a second new genus); new Genera of Entozoa. Vol. 4, pp. 225–33.

On the Existence of Entophyta in Healthy Animals, as a Natural Condition. Vol. 4, pp. 225–33.

Observations on the Character and Intimate Structure of the Odoriferous Glands of the Invertebrata. Vol. 4, p. 234–6, 3 figs.

New genus and species of Entophyta. Vol. 4, pp. 249–50.

1850.

Remarks on Entophyta. Vol. 5, pp. 7–8.

Verbal, April 9, that he had observed in the stomach of the larva of Arctia isabella that the nucleus of every epithelial cell contained an octahedral crystal, the axis of which measured about 1.3760th of an inch, etc., etc. Vol. 5, p. 32.

On Crystalline Bodies in the tissues of plants. Vol. 5, pp. 32–3.

On Rhinoceros occidentalis. Vol. 5, p. 119.

Descriptions of new Entophyta growing within Animals. Vol. 5, p. 35.

Eucrotaphus Jacksoni, and Archæotherium Mortoni, from Fragments of Crania found in Cumberland Co., Pa. Vol. 5, pp. 92–3.

Contributions to Helminthology. Vol. 5, pp. 96–8.

Notes on the Development of the Gordius aquaticus. Vol. 5, pp. 98–100.

Two New Species of Infusorial Entozoa. Vol. 5, p. 100.

Descriptions of some Nematoid Entozoa infesting Insects. Vol. 5, pp. 190–202.

Descriptions of Three Filaria. Vol. 5, pp. 117–8.

Remarks on the Nettling Organs of the Hydra. Vol. 5, pp. 119–121.

On some fossil mammalian remains: Rhinoceros Nebraskensis; Palæotherium Bairdii; Merycoidodon Culbertsonii and Agriochœrus antiquus. Vol. 5, pp. 121–2.

Descriptions of New Genera of Vermes. Vol. 5, pp. 124–6.

1851.

Descriptions of New Species of Entozoa. Vol. 5, p. 155.

On Some Fragments of Palæotherium Proutii. Vol. 5, pp. 170–1.

Fossil Tortoise, Stylemys Nebrascensis. Vol. 5, p. 172.

Testudo lata—Emys hemispherica. Vol. 5, p. 173.

On the Fungus Disease of Cicada septemdecem. Vol. 5, p. 235.

Verbal, May 6, on transplanting cancer. Vol. 5, p. 201.

Verbal, May 16, that he had found a dead Mole Cricket (Grillo talpa Americana), perfect in all its parts, the body of which was everywhere filled with a parasitic fungus, the elliptical or globular sporules of which averaged 1.2333d of an inch in diameter. Vol. 5, p. 204.

Contributions to Helminthology. Vol. 5, pp. 205–9.

Helminthological Contributions, No. 2. Vol. 5, pp. 221–7.

Remarks on Fragments of fossil ruminant ungulates. Vol. 5, p. 237–9.

Helminthological Contributions, No. 3. Vol. 5, p. 239–44.

Plumatella diffusa, a branching fresh-water ciliated Polyp. Vol. 5, pp. 261–2.

Description of Cristatella magnifica. Vol. 5, p. 265.

Description of Spongilla fragilis. Vol. 5, p. 278.

Corrections and additions to former papers on Helminthology. Vol. 5, pp. 281–90.

Verbal, Nov. 4, that he had examined the fossil saurian bones presented by Mr. Nash, and found that they belong to a new species of Crocodile which he had named Crocodilus antiquus. Vol. 5, p 307.

Descriptions of Balæna palæatlantica and Balæna prisca, Leidy, based on fragments of fossil bones from the Miocene formation of Virginia. Vol. 5, pp. 308–9.

On some American fresh-water Polyzoa. Vol. 5, pp. 320–2, 1 plate with 5 figs.

Verbal, on fossil reptilian and mammalian remains found in the green sand of New Jersey: Cimoliasaurus magnus; Discosaurus vetustus; Priscodelphinus Harlani; Priscodelphinus grandævus; Crocodilus fastigiatus; Emys Oweni, all Leidy. Vol. 5, p. 325–8.

Fossils from the Green Sand of New Jersey, named Chelonia grandæva; Trionyx priscus; Machairodus primævus, Leidy. Vol. 5, pp. 329–30.

Contributions to Helminthology. Vol. 5, pp. 349–51.

1852.

Verbal, Jan. 6, remarks on Rhinoceros Americanus, named from fragments of fossil bones collected in Nebraska. Vol. 6, p. 2.

Verbal, Jan. 13, that the Cetacean remains, which he had named Priscodelphinus, are the first relics of mammals found in the Cretaceous group. Vol. 6, p. 3.

Verbal, Feb. 10, on Emys Culbertsonii, a new species. Vol. 6, p. 34.

Verbal, Feb. 17, on Delphinus Conradi, and a new genus and species, Thoracosaurus grandinis. Vol. 6, p. 35.

Verbal, March 2, on Pontogeneus priscus. Vol. 6, p. 52.

Verbal, March 16, Pointing out that heads of the Hippopotamus from N. W. Africa differ from those from Southern Africa. Vol. 6, p. 53.

Verbal, March 28, on a fine skeleton of Troglodytes Gorilla, presented by Dr. Henry A. Ford of Liberia. Vol 6, p. 53.

On Fossil Tortoises from Nebraska. Vol. 6, p. 59.

Verbal, May 4, notice of an extinct species of Ox, and Bootherium. Vol. 6, p. 71.

On the Red Snow of the Arctic Regions. Vol. 6, p. 59.

On the Honey Ant of Mexico. Vol. 6, p. 72.

Remarks on various fossil teeth. Vol. 6, p. 241.

On some fossil fragments from Natches. Vol. 6, p. 303.

Verbal, July 6, remarks on Bison latifrons (Leidy) and B. antiquus Leidy; and on several species of Megalonyx (3 Leidy). Vol. 6, p. 117.

1853.

Verbal, March 8, notice of three species of fossil Ursus. Vol. 6, p. 303.

Verbal, Aug. 2, remarks on Cetacean fossil bones in the green sand of N. J.; and on Cetacean fossils from other localities. Vol. 6, p. 377.

Verbal, Nov. 1, notice of fishes being infested with a parasitic worm of the genus Distoma. Vol. 6, p. 433.

Remarks on a collection of fossil mammalia and chelonia from the Mauvaises Terres of Nebraska. Vol. 6, pp. 392–4.

1854.

Verbal, May 23, account of fossil vertebræ of extinct saurians, which he named Breinosaurus grandis and Cimoliasaurus magnus, illustrated by 6 figs. on a plate. Vol. 7, p. 72.

Verbal, June 6, on Bison latifrons, Arctodus pristinus, Hippodon speciosus and Merycodus necatus. Vol. 7, pp. 89–90.

Synopsis of Extinct Mammalia from Nebraska. Vol. 7, pp. 156–7.

On Denictis felina. Vol. 7, p. 127.

On Hydrachma. Vol. 7, p. 202.

Description of a fossil apparently Indicating an extinct Species of the Camel Tribe. Vol. 7, pp. 172–3.

On Urnatella gracilis and a New Species of Plumatella. Vol. 7, pp. 191–2.

Notice of some Fossil Bones Discovered by Mr. Francis A. Lincke in the Banks of the Ohio River. Vol. 7, pp. 199-201.

Remarks on the question of the identity of Bootherium cavifrons with Ovibos moschatus, or O. maximus. Vol. 7, pp. 209-10.

1855.

On a so-called Fossil Man. Vol. 7, p. 34.

Indications of twelve species of Fossil Fishes. Vol. 7, pp. 395-7.

Indications of five species with two new genera of Extinct Fishes. Vol. 7, p. 414.

Notices of some Tape Worms. Vol. 7, pp. 443-4.

1856.

Verbal, Jan. 15, on Filaria canis cordis filling the right auricle and right ventricle of the heart of a dog, which was exhibited. Vol. 8, p. 2.

Description of two Ichthyodorulites. Vol. 8, pp. 11-2.

Synopsis of Entozoa and some of their Ecto-congeners, observed by the Author. Vol. 8, pp. 42-58.

Notices of some Remains of Extinct Mammalia recently discovered by Dr. F. V. Hayden in the Bad Lands of Nebraska. Vol. 8, p. 59.

Notices of Extinct Reptiles and Fishes, discovered by Dr. F. V. Hayden in the Bad Lands of Judith River, Nebraska Territory. Vol. 8, pp. 72-6.

Notices of Remains of Extinct Mammalia, discovered by Dr. F. V. Hayden in Nebraska Territory. Vol. 8, pp. 90-1.

Notice of the Remains of a species of Seal from the postpliocene deposit of the Ottowa River. Vol. 8, pp. 90-1, with a plate.

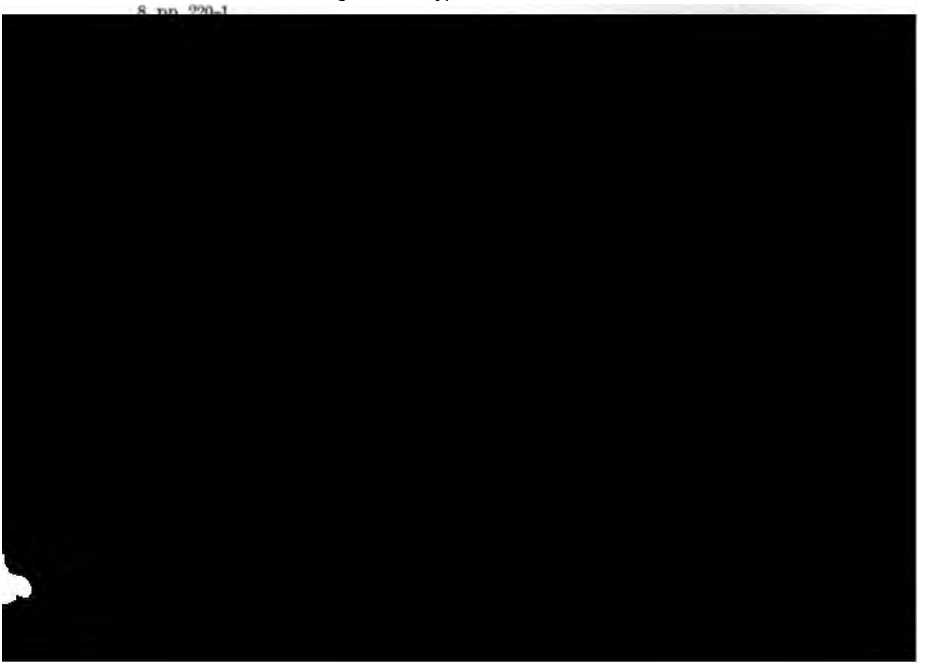
Notices of several genera of Extinct Mammalia previously less perfectly characterized. Vol. 8, pp. 91-2.

Verbal, Sept. 16, in reference to the color of the eyes of Platyphyllum concerum (Katydid) being greenish by day and cherry red at night. Vol. 8, p. 162.

Verbal, Sept. 16, that oyster and clam shells are perforated by a sponge of the genus Cliona. Vol. 8, p. 162-3.

Notice of some remains of Extinct Vertebrated Animals. Vol. 8, pp. 163-5.

Notices of remains of extinct vertebrated animals of New Jersey, collected by Prof. Cook of the State Geological Survey, under the direction of Dr. W. Kitchell. Vol. 8, pp. 220-1.



Verbal, Dec. 22, on a curious animalcule found on stones and dead plants in the Schuylkill and Delaware rivers. Vol. 9, p. 204.

Verbal, Dec. 22, observations on the introduction of camel into North America. Vol. 9, p. 210.

1858.

Verbal, Jan. 12, that the stomachs of Urnatella gracilis contained voluntary moving bodies, which might prove to be generative bodies. Vol. 10, p. 1.

Verbal, Jan. 19, that the extinct camel seemed to be about two-thirds the size of the recent species. Vol. 10, p. 2.

Verbal, Feb. 2, that the fossil remains from the Niobrara river belong to some twenty or more species which are distinct from those found in the Miocene of the Mauvaises Terres, as well as from those of a subsequent age. Vol. 10, p. 7.

Verbal, March 2, that with the collection of fossils received from the vicinity of Kansas river, were several masses of a yellowish magnesian limestone containing numerous casts of a very peculiar group of fossils; that among the specimens found in the valley of the Niobrara river, Nebraska, is the lower jaw of a new species of Mastodon. Vol. 10, p. 10.

Verbal, March 9, that after inspecting numerous equine remains from Niobrara, he inclines to believe that the remains of the horse found in the Postpliocene deposits of the United States indicate two species. Vol. 10, p. 11.

Notices of remains of Extinct Vertebrata from the valley of the Niobrara River, collected during the Exploring Expedition of 1857, in Nebraska, under the command of Lieut. C. K. Warren, U. S. Top. Eng., by Dr. F. V. Hayden, Geologist to the Expedition. Vol. 10, pp. 20–9.

Verbal, April 6, that in the collection from Niobrara two additional species of the ancient camel are indicated: Procamelus robustus and P. gracilis. He mentioned that fractured fossils are best mended by saturating them with melted beeswax. Vol. 10, p. 89.

Verbal, April 13, that he had named a fresh-water worm which lives in tubes of mud Manayunkia speciosa. Vol. 10, p. 90.

Contributions to Helminthology. Vol. 10, pp. 110–2.

Verbal, June 29, that one-half of the chrysalides of the canker-worm were infected by two species of Ichneumon. Vol. 10, p. 137.

Verbal, Nov. 2, that he and Dr. Bridges, in Lily pond, near Newport, R. I., had found a species of Cristatella. Vol. 10, pp. 188–90.

Verbal, Dec. 14, that the fossil bones obtained from Haddonfield, N. J., and given to him by Mr. Foulke for description, belonged to a huge extinct herbivorous Saurian, which he named Hadrosaurus Foulkii. Vol. 10, pp. 215–8.

1859.

Verbal, Jan. 11, that he had found the Manayunkia speciosa (a curious fresh-water worm, a drawing of which he exhibited) in great abundance at the foot of the cliffs washed by the ocean near Newport, R. I. Vol. 11, p. 2.

Verbal, Jan. 18, that from fossil remains of cartilaginous fishes, found in the carboniferous formations of Kansas, he had made three species. Vol. 11, p. 3.

Verbal, March 22, remarks on a Mastodon tooth from Tambla, Honduras; and teeth and fragments of teeth of Mososaurus from the green sand of New Jersey. Vol. 11, p. 91.

Verbal, April 12, in reference to ferruginous rock containing remains of fishes. Vol. 11, p. 110.

Verbal, April 19, in reference to fossil bones contained in so-called guano from Sombrero, W. I., which were exhibited. Vol. 11, p. 111.

Verbal, May 17, on specimens of Patæobrochus from subsilurian strata which he considered fossil, though its organic nature had been denied. Vol. 11, p. 150.

Verbal, Aug. 23, remarks on an antler of a reindeer, and on an animalcule, a drawing of which was submitted, found at Newport, R. I., named Freyia Americana. Vol. 11, p. 194.

1860.

Verbal, Feb. 11, that Albertite is a product from the distillation of bituminous coals or shales, and is perfectly amorphous. Vol. 12, p. 54.

Verbal, March 13, on Hyalomena from Japan. Vol. 12, p. 85.

Verbal, April 3, that experiments with Trichina spiralis, by Prof. Leuckart, of Giessen, imply that the animal finds its way into the human body through food or drink. Vol. 12, p. 96.

Verbal, July 24, notice of a specimen of Hyla. Vol. 12, p. 305.

Verbal, Oct. 9, that the specimens of fossil bones from Washington Co., Texas, indicated a new equine genus, and a species of Hippotherium. Vol. 12, p. 416.

Verbal, Oct. 16, notice of an extinct Peccary. Vol. 12, p. 416.

1861.

Verbal, April 16, that lignite had been discovered at the border of the new red sandstone on Plymouth creek, near Norristown, Pa. Vol. 13, p. 77.

1862.

Verbal, Nov. 18, that he had noticed a boulder, apparently of Potsdam sandstone, at the corner of Thirty-seventh and Market streets, exposed by digging gravel, which is the largest transported block he had observed in our vicinity. Vol. 14, p. 307.

1863.

Verbal, Sept. 15, that he had found a Phalangopsis rolled in a leaf of a spice bush. Vol. 15, p. 212.

Verbal, Nov. 3, on specimens of Nostoc pruneiforme. Vol. 15, p. 281.

1865.

Verbal, May 23, that a boring sponge existed during the Cretaceous period. Vol. 17, p. 77.

Verbal, June 6, that fossil remains of horses had been found throughout the length and breadth of the North American continent. Vol. 17, p. 94.

Verbal, June 20, that he had found at Cape Henlopen, in a kitchen refuse heap, a clay pipe. Vol. 17, p. 95.

Verbal, Sept. 5, remarks on a fœtal dog-shark. Vol. 17, p. 175.

Verbal, Sept. 19, in reference to fossil bones of Rhinoceros. Vol. 17, p. 176.

Verbal, Oct. 10, remarks on specimens of oölitic phosphates of lime and alumina; also on human bones from a guano deposit on the Island Orchilla, W. I. Vol. 17, p. 181.

1866.

Verbal, Jan. 2, on part of a human skull of the so-called pigmy race, from near the mouth of Stone river, Tennessee. Vol. 18, p. 1.

Verbal, March 20, on a large phalanx of an extinct reptile; and stated that he was the first to discover the Trichina spiralis in the hog (while eating a slice of pork, he noticed some minute specks which recalled to mind the Trichina spots seen in the muscles of a human subject only a few days previously). Vol. 18, p. 9.

Verbal, May 22, that in the salt mine of the Island of Petite Anse, La., were grains of precious garnet, olivine, bones of the elephant, etc. Vol. 18, p. 109.

Verbal, June 5, in reference to a small collection of fossils from Bangor, Maine. Vol. 18, p. 237.

Verbal, Oct. 23, in reference to molar teeth of Mastodon ohioticus. Vol. 18, p. 290.

Verbal, Dec. 4, in reference to Drepanodon or Machairodus occidentalis, fragments of bones of which were shown. Vol. 18, p. 345.

1867.

Verbal, June 25, in reference to Bison antiquus. Vol. 19, p. 85.

Verbal, Sept. 10, on a fossil skull of Geomys bursarius. Vol. 19, p. 97.

Verbal, Sept. 17, on a fossil skull of Castoroides ohioensis. Vol. 19, p. 97.

Verbal, Oct. 1, in reference to specimens of black horn stone exhibited. Vol. 19, p. 125.

1868.

Verbal, June 2, that some Sombrero guano contains ninety per cent. of phosphate of lime. Vol. 20, p. 156.
Notice of some Vertebrate Remains from Harden County, Texas. Vol. 20, pp. 174–6.
Indications of an Elotherium in California. Vol. 20, p. 177.
Notice of some Reptilian Remains from Nevada. Vol. 20, pp. 177–8.
Notice of some Vertebrate Remains from the West Indian Islands. Vol. 20, pp. 178–80.
Notice of some Remains of Horses. Vol. 20, p. 195.
Notice of some Extinct Cetaceans. Vol. 20, pp. 196–7.
Remarks on a Jaw fragment of Megalosaurus. Vol. 20, pp. 197–200.
Remarks on Conosaurus of Gibbes. Vol. 20, pp. 200–2.
Notice of American species Ptychodus. Vol. 20, pp. 205–8.
Verbal, Oct. 20, that he found the stomach of a shad full of small fishes. Vol. 20, p. 228.
Notice of some American Leeches. Vol. 20, 229–30.
Notice of the remains of extinct Pachyderms. Vol. 20, pp. 230–2.
Verbal, Nov. 3, in reference to specimens seemingly of coprolites from the Huronian slates. Vol. 20, pp. 302–3.
Verbal, Nov. 3, that iridescence in opals is caused by striæ, 6000 to the inch. Vol. 20, p. 303.
Verbal, Dec. 1, on asterism in mica. Vol. 20, p. 313.
Notice of some remains of extinct Insectivora. Vol. 20, p. 315.

1869.

Notice of some extinct vertebrates from Wyoming and Dakota. Vol. 21, pp. 63–7.

1870.

Verbal, Jan. 4, description of Megacerops Coloradensis. Vol. 22, pp. 1, 2.
Verbal, Jan. 11, remarks on Poicilopleuron and other fossils submitted for examination by Prof. Hayden. Vol. 22, pp. 3–5.
Verbal, March 1, remarks on the right humerus of one of the extinct giant Sloths resembling Mylodon robustus, and on Dromotherium sylvestre, submitted for examination by the Smithsonian Institution. Vol. 22, pp. 8, 9.
Verbal, March 8, remarks on reptilian remains from the Cretaceous formation near Fort Wallace, Kansas, described by Prof. Cope under the name of Elasmosaurus platyurus. Vol. 22, p. 9.
Verbal, March 22, observations on ichthyodorulites, of which specimens were shown; on a metacarpal bone of Megalonyx Jeffersoni, and on a last lower grinder of Bison antiquus. Vol. 22, pp. 12–3.
Verbal, April 5, remarks on Discosaurus and its allies. Vol. 22, pp. 18–22.
Verbal, May 3, description of the internal generative organs of a hog, which were exhibited. Vol. 22, p. 65.
Verbal, May 17, remarks on some fossil bones from the Pliocene formation in the Mauvaises Terres of Dakota, which were shown. Vol. 22, pp. 65–6.
Verbal, June 14, observations on mammalian fossil remains, submitted for examination, from Idaho, from Utah, and from Oregon; also, on Hadrosaurus and its allies. Vol. 22, pp. 66–9.
Verbal, June 21, notice of two fossil fragments belonging to Bison americanus and Elephas americanus. Vol. 22, pp. 69–71.
Verbal, July 5, remarks on differences between animals of the same species inhabiting Europe and America. Vol. 22, p. 72.
Verbal, July 12, remarks on a mutilated portion of the lower jaw of a large ruminant supposed to belong to Ovibos cavifrons. Vol. 22, p. 73.
Verbal, July 19, observations on a fossil, which he exhibited and named Nothosaurus occiduus. Vol. 22, p. 74.
Verbal, Aug. 2, description of Nephelis punctata, a new leech. Vol. 22, pp. 89–90.

Verbal, Sept. 20, account of a fossil crocodile, which he named Crocodilus Elliotti ; remarks on Urnatella and Manayunkia. Vol. 22, pp. 100–2.
Verbal, Oct. 4, reference to a small collection of fossils from Wyoming, most of which pertain to Merycochœrus. Vol. 22, pp. 109–10.
Verbal, Oct. 18, remarks on some fossil remains which belong to Oreodon. Vol. 22, pp. 111–3.
Verbal, Oct. 25, observations in reference to several boxes of fossils from Fort Bridger, among which were Microsus cuspidatus and Notharctus tenebrosus, etc. Vol. 22, p. 113.
Verbal, Nov. 1, notice of Graphiodon vincarius. Vol. 22, p. 122.
Verbal, Nov. 8, descriptions of fossil species: Emys Jeanesi, Emys Haydeni, Baena arenosa, Saniwa ensidens. Vol. 22, pp. 123–4.
Verbal, Nov. 15, observations on fossils submitted for examination by Prof. J. D. Whitney, among which are fragments representative of the llama, camel, Hipparion and Protohippus. Vol. 22, pp. 125–7.

1871.

Verbal, Feb. 6, remarks on fossil bones from California. Vol. 23, p. 50.
Verbal, March 21, notice of Tænia canallata. Vol. 23, p. 53.
Verbal, April 18, observations on extinct turtles from Wyoming. Vol. 23, p. 102.
Verbal, May 9, remarks on polydactylism in a horse. Vol. 23, p. 112.
Verbal, May 16, observations on some fossil remains of Mastodon and horse in North Carolina; and of mammals from Wyoming. Vol. 23, pp. 113–6.
Verbal, June 5, on fossil Testudo of Wyoming ; on supposed fossil turtle eggs ; and on garnets from Green's creek, Delaware Co., Pa. Vol. 23, pp. 151–5.
Verbal, July 4, on some fossils from Fort Bridger. Vol. 23, p. 197.
Verbal, Aug. 1, on Mastodon remains from California ; on Anchitherium. Vol. 23, pp. 198–9.
Verbal, Aug. 8, on fossil vertebrates from Wyoming. Vol. 23, pp. 228–9.
Verbal, Aug. 29, on extinct Rodents. Vol. 23, pp. 130–2.
Verbal, Oct. 10, on the minerals of Mount Mica. Vol. 23, pp. 245–7.
Verbal, Oct. 17, on fossils from Oregon. Vol. 23, pp. 247–8.
Verbal, Nov. 21, on the communication of contagion by flies. Vol. 23, p. 297.
Verbal, Dec. 12, on several worms. Vol. 23, pp. 305–7.



Verbal, Oct. 15, in reference to Uintatherium and other fossil remains; to chipped stones; a stone implement; and to the action of sand and wind on rocks of Wyoming. Vol. 24, pp. 240–3.
Verbal, Nov. 5, notice of fossils from Wyoming. Vol. 24, pp. 267–8.
Verbal, Dec. 10, notices of fossils from Wyoming. Vol. 24, pp. 277–8.

1873.

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Verbal, March 18, notice of an extinct hog found in the Pliocene sands of Niobrara river. Vol. 25, p. 207.
Verbal, April 1, notices of bituminous coal from Westmoreland, Pa.; of a black rat; and of a specimen of iron ore. Vol. 25, p. 257.
Verbal, April 15, notices of extinct mammals of California. Vol. 25, pp. 259–60.
Verbal, April 22, notice of a fungus parasite on a mouse. Vol. 25, p. 260.
Verbal, Oct. 14, notice of Distoma hepaticum. Vol. 25, p. 361.
Verbal, Dec. 9, notice of Lingula found in the stomach of a fish taken in the Susquehanna river. Vol. 25, p. 215.
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Verbal, Dec. 23, notice of intercellular circulation in plants, as in Vaucheria. Vol. 25, p. 420.

1874.

Verbal, Jan. 13, notice of Hydra, Vol. 26, p. 10.
Verbal, Feb. 3, notice of Protozoa. Vol. 26, pp. 13–5.
Verbal, Feb. 17, on the mode of growth of Desmids. Vol. 26, p. 15.
Verbal, March 24, on Actinophrys. Vol. 26, pp. 23–4.
Verbal, April 21, on the enemies of Difflugia; and on a supposed compound derived from leather. Vol. 26, p. 75.
Verbal, May 12, notice of some new fresh-water Rhizopods. Vol. 26, pp. 77–9.
Verbal, June 16, observations on some fresh-water and terrestrial Rhizopods. Vol. 26, pp. 86–9.
Verbal, Aug. 25, observations on Pectinatella magnifica; on a parasitic worm which infests the house-fly; and on some fresh-water Infusoria. Vol. 26, pp. 139–40.
Verbal, Sept. 8, notice of a remarkable Amœba; its process or mode of swallowing. Vol. 26, pp. 162–3.
Verbal, Sept. 15, on the motive power of Diatomes. Vol. 26, p. 143.
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Verbal, Oct. 5, notice of some Rhizopods. Vol. 26, pp. 155–7.
Verbal, Oct. 20, notice of Dryocampa. Vol. 26, p. 160.
Verbal, Nov. 10, notices of remains of Titanotherium; on supposed spermaries in Amœba; and of Rhizopods. Vol. 26, pp. 165–8.
Verbal, Dec. 15, notice of some fossils presented. Vol. 26, p. 223.
Verbal, Dec. 22, observations on Rhizopods. Vol. 26, pp. 225–7.

1875.

Verbal, Jan. 19, report of a fungus in a Flamingo. Vol. 27, p. 11.
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Verbal, April 6, observations on a coal fossil; on elephant remains; and on Stephanoceros. Vol. 27, pp. 120–2.
Verbal, April 20, observations on a curious Rhizopod; on Psorosperms in a mallard duck; on a mouthless fish; and on Ouramœba. Vol. 27, pp. 124–7.
Verbal, Sept. 7, on Mermis acuminata. Vol. 27, p. 400.

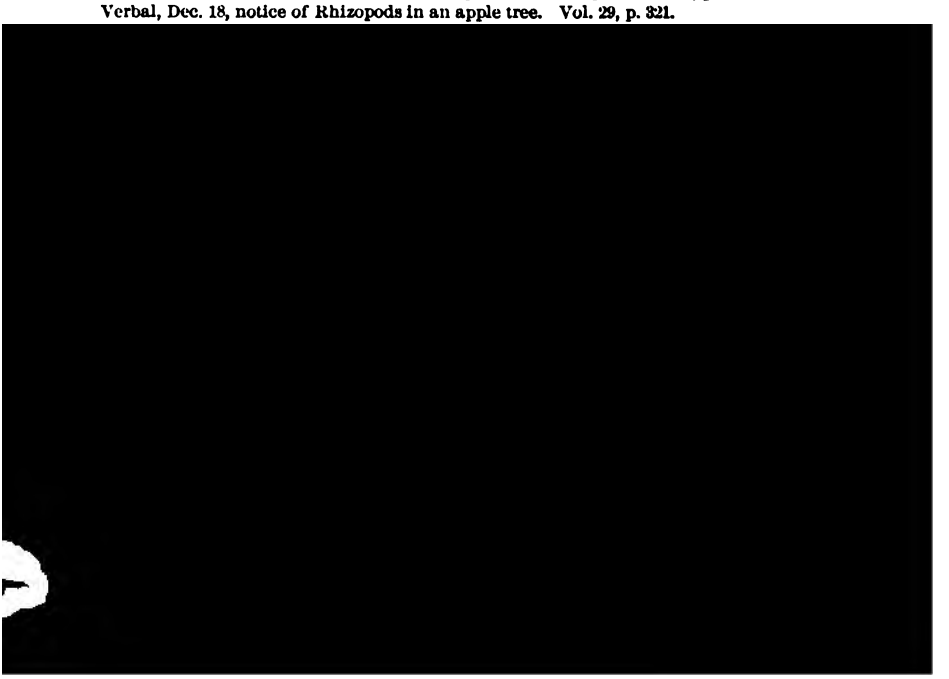
Verbal, Oct. 4, observations on Rhizopods, and on Quercus heterophylla. Vol. 27, pp. 413–5.

1876.

Verbal, Jan. 4, observation on Petalodus. Vol. 28, p. 9.
Verbal, March 21, notice of Mastodon andium. Vol. 28, p. 38.
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Verbal, May 9, remarks on fossils from the Ashley phosphate beds. Vol. 28, pp. 80–1.
Verbal, June 20, observations on vertebrate fossils from South Carolina. Vol. 28, p. 114.
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Verbal, Oct. 10, on the structure of precious opal; and on Rhizopods. Vol. 28, pp. 195–9.
Verbal, Dec. 5, remarks on Ozocerite and Hyraceum. Vol. 28, pp. 325–6.

1877.

Verbal, Jan. 30, on the present contamination of the drinking water; on Eozoön canadense; and an instance in which the dome of the human diaphragm was elevated to a level of the anterior extremity of the first rib. Vol. 29, p. 20.
Verbal, April 3, remarks on the yellow ant. Vol. 29, p. 145.
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Verbal, May 29, in reference to flukes which infest common fresh-water mollusks. Vol. 29, pp. 200–2.
Verbal, June 12, on parasitic Infusoria. Vol. 29, pp. 259–60.
Verbal, June 19, remarks on seventeen-year locust, the Hessian fly and a Chelifer. Vol. 29, pp. 260–1.
Verbal, June 26, account of the birth of a Rhizopod. Vol. 29, pp. 261–5.
Verbal, Sept. 4, remarks on the bedbug and its allies. Vol. 29, p. 284.
Verbal, Oct. 2, account of the Dinamœba's mode of feeding. Vol. 29, pp. 288–90.
Verbal, Oct. 9, remarks on the discrimination of a Heliozoön in selecting food. Vol. 29, pp. 291–2.
Verbal, Oct. 23, remarks on Rhizopods, and on fossil fishes. Vol. 29, pp. 296–4.
Verbal, Nov. 13, remarks on ants. Vol. 29, p. 304.
Verbal, Nov. 27, remarks on the American species of Difflugia. Vol. 29, p. 306.
Verbal, Dec. 18, notice of Rhizopods in an apple tree. Vol. 29, p. 321.



Verbal, July 8, notice of fossil foot-tracks in the anthracite coal measures. Vol. 31, pp. 164–5.
Verbal, July 22, account of the explosion of a diamond. Vol. 31, p. 195.
Verbal, Sept. 5, remarks about some small animals on the coast of New Jersey. Vol. 31, p. 198.
Verbal, Sept. 30, on Cristatella Idæ. Vol. 31, p. 203.
Verbal, Oct. 7, on the Amœba Blattæ. Vol. 31, pp. 204–5.

1880.

Verbal, Jan. 20, remarks on specimens of Filaria immitis of the dog. Vol. 32, pp. 10–2.
Verbal, March 2, remarks on a species of Filaria, alleged to have been drawn from a man. Vol. 32, pp. 130–1.
Verbal, April 13, notices of pond life near Woodbury, N. J. Vol. 32, pp. 156–8.
Rhizopods in the mosses of the summit of Roan mountain, North Carolina. Vol. 32, pp. 333–40.
Verbal, Sept. 21, account of a visit to a bone cave near Stroudsburg, Pa. Vol. 32, pp. 346–9.

1881.

Verbal, Jan. 4, notice that Rhizopods are eaten by young fishes. Vol. 33, pp. 9–10.

1882.

Verbal, Jan. 3, remarks on some rock specimens. Vol. 34, pp. 10–2.
Verbal, Feb. 7, notice of Filaria in black bass. Vol. 34, p. 69.
Verbal, Feb. 28, remarks on his collection of Tourmalines, which he exhibited. Vol. 34, pp. 71–3.
Verbal, March 7, notice of Balanoglossus aurantiacus; and of Scolithus. Vol. 34, p. 93.
Verbal, April 4, remarks on Sagitta. Vol. 34, p. 102.
Verbal, May 2, remarks on some Entozoa found in birds; also on a coprolite and a pebble resembling an Indian hammer. Vol. 34, pp. 109–10.
Verbal, May 23, remarks on Bacillus anthracis; on Enchytræus, Distichopus and their parasites. Vol. 34, pp. 145–8.
Verbal, May 30, notice of the yellow ant. Vol. 34, p. 148.
Verbal, Sept. 5, remarks on Balanus. Vol. 34, p. 224–5.
Verbal, Sept. 26, remarks on a collection of tobacco worms, which he exhibited. Vol. 24, pp. 237–8.
Verbal, Oct. 17, notice of a new species of Pyxicola. Vol. 34, pp. 252–3.
Verbal, Oct. 31, remarks on Actinosphærium Eichornii. Vol. 34, p. 260.
Verbal, Nov. 7, notice of topaz and biotite. Vol. 34, p. 261.
Verbal, Nov. 14, on Actinosphærium, and Tubularia crocea. Vol. 34, pp. 261–2.
Verbal, Dec. 12, remarks on fossil remains of horses. Vol. 34, pp. 290–1.
Verbal, Dec. 19, remarks on an extinct peccary. Vol. 34, pp. 301–2.

1883.

Verbal, Feb. 12, remarks on the reproduction of Anodonta fluviatilis and its parasites. [Vol. 35], pp. 44–6.
Verbal, April 24, remarks on a social Heliozoan. [Vol 35], pp. 95–6.
Manayunkia speciosa. [Vol. 35], pp. 204–12, 24 figures.
Verbal, Dec. 11, notice of a fungus infesting flies; and remarks on Manayunkia. [Vol. 35], p. 302.

1884.

Verbal, Jan. 1, notice of an ant infested by a fungus; and of Cassiterite from Dakota. [Vol. 36], p. 9.

Verbal, Jan. 16, account of the effects of the storm, Jan. 8, on marine animals of the New Jersey coast. [Vol. 36], pp. 12–3.
Verbal, Jan. 29, remarks on a collection of fossil bones from Louisiana; and on Foraminifera in the drift of Minnesota. [Vol. 35], p. 22.
Verbal, Feb. 26, notice of Distoma and Filaria. [Vol. 35], p. 47.
Verbal, March 4, reference to Dictyophora and Apsilus vorax. [Vol. 35], p. 50.
Verbal, March 18, notice of Eumeces chalcides. [Vol. 35], p. 66.
Verbal, April 22, remarks on vertebrate fossils from Florida. Vol. 35, pp. 118–9.
Verbal, May 6, account of a rare human tapeworm. [Vol. 35], p. 137.
Verbal, May 13, description of Pentastomum proboscideum. [Vol. 35, p. 140.
Verbal, Oct. 28, notice of living organisms found in ice. [Vol. 35], p. 260.

1885.

Verbal, Jan. 13, notice of parasitic worms found in birds. [Vol. 36], pp. 9–11.
Verbal, March 10, notice of fossil remains of Rhinoceros and Hypotherium from Florida. [Vol. 36], pp. 32–3.
Verbal, March 24, remarks on fossil Mylodon. [Vol. 36], pp. 49–51.
Verbal, May 19, notice of Bothriocephalus in a trout. [Vol. 36], pp. 122–3.
Verbal, Dec. 22, notice of living worms in ice; Lumbricus glacialis. [Vol. 36], p. 408.

1886.

Verbal, Jan. 19, remarks on fossil bones of Mastodon and Llama from Florida. [Vol. 36], p. 11.
Verbal, Feb. 23, description of an extinct boar from Florida; and notice of caries in the Mastodon. [Vol. 36], pp. 37–8.
Verbal, March 23, notice of Amia and its probable Tænia. [Vol. 36], pp. 62–3.
Verbal, June 1, notice of Toxodon and other remains from Nicaragua. [Vol. 36], pp. 275–7.
Notices of Nematoid worms. [Vol. 36], pp. 308–13.

1887.

Notice of some parasitic worms. [Vol. 37], pp. 20–1.

Verbal, Nov. 27, remarks on the fauna of Beach Haven, N. J. [Vol. 38], pp. 329-33.
Verbal, Dec. 11, notice of the food of barnacles. [Vol. 38], p. 431.

1889.

Verbal, Jan. 1, remarks, with illustrations, on several gregarines, and a singular mode of conjugation of one of them. [Vol. 39], pp. 9-11.
Verbal, Feb. 19, remarks on a fossil remnant of the sabre-tooth tiger from Florida. [Vol. 39], pp. 29-31.
Verbal, March 5, notice of Gonyleptes and Solpuga. [Vol. 39], p. 15.
The Boring Sponge, Cliona. [Vol. 39], pp. 70-5.
Verbal, April 16, notice of a parasitic Copepod. [Vol. 39], p. 95.
Verbal, April 23, remarks on fossil vertebrates from Florida. [Vol. 39], pp. 96-7.

1890.

Verbal, March 4, notice of Hypoderas in the Little Blue Heron; and of an ichneumon fly. [Vol. 39], p. 63.
Verbal, March 25, remarks on fossil vertebrates from Florida. [Vol. 39], p. 64.
Verbal, May 20, remarks on Hippotherium and Rhinoceros from Florida. [Vol. 39], pp. 182-3.
Verbal, May 27, remarks on Mastodon and Capybara of South Carolina. [Vol. 39], pp. 184-5.
Verbal, Sept. 23, remarks on Ticks. [Vol. 39], pp. 278-80.
Verbal, Sept. 30, notice of parasites of Mola rotunda. [Vol. 39], pp. 281-2.
Verbal, Oct. 7, notice of Beroe on the New Jersey coast. [Vol. 39], p. 341.
Notices of Entozoa. [Vol. 39], pp. 410-8.
Verbal, Nov. 11, notice of Velella. [Vol. 39], p. 408.

1891.

Verbal, Feb. 17, notice of the Boring Sponge of the Oyster. [Vol. 40], p. 122.
Notice of some Entozoa. [Vol. 40], pp. 234-6.
Dr. Leidy presided for the last time at the meeting of April 14.

Many of the above communications were copied by foreign and domestic periodicals, and many of them he included in elaborate essays on the same subjects.

TRANSACTIONS OF THE WAGNER FREE INSTITUTE OF SCIENCE OF PHILADELPHIA.
[Small Quarto.]

Notice of some fossil human bones. Vol. 2, pp. 9-12, 2 plates, Dec., 1889.
Description of Mammalian remains from a rock crevice in Florida. Vol. 2, pp. 15-7, 2 plates, Dec., 1889.
Description of Vertebrate remains from Peace Creek, Florida. Vol. 2, pp. 19-31, 2 plates, Dec., 1889.
Notice of some Mammalian remains from the salt mine of Petite Anse, Louisiana. Vol. 2, pp. 33-40, 1 plate, Dec., 1889.
On Platygonus, an extinct genus allied to the Peccaries. Vol. 2, pp. 41-50, Dec., 1889.
Remarks on the nature of Organic Species. Vol. 2, pp. 51-3.

MISCELLANEOUS.

Notice of the formation of some crystalline bodies in Collodion. Amer. Jour. Pharmacy, Vol. 16, pp. 24-6, 1850.
Remarks on some curious Sponges. American Naturalist, Vol. 4, pp. 17-22, 12 figures, 1871.

PROC. AMER. PHILOS. SOC. XXX. 138. X. PRINTED MAY 9, 1892.

In Science :

Study of the temporal bone. Illustrated. Vol. 1, Part 1, pp. 380-5 ; Part 2, pp. 475-7 ; Part 3, pp. 506-7, 1883.

Crystals in the bark of trees. Illustrated. Vol. 2, pp. 707-8, 1883. Manayunkia is noticed p. 762.

The Journal of Comparative Medicine and Surgery [Dr. Leidy was one of its collaborators in the department of Comparative Anatomy and Physiology] :

Tapeworm in Birds. Vol. 8, pp. 1-11, 27 figures, Jan., 1887.

Parasites of the Shad and Herring. Vol. 9, pp. 211-5, July, 1888.

Addresses by Dr. Joseph Leidy.

A lecture introductory to the Course of Anatomy, delivered in the University of Pennsylvania, 1853. 8vo, pp. 22.

Valedictory address to the class of medical graduates at the University of Pennsylvania, March 27, 1858. 8vo, pp. 32.

Lecture introductory to the Course of Anatomy in the University of Pennsylvania, for the session 1858-9. 8vo, pp. 24.

Introductory lecture to the Course of Anatomy in the University of Pennsylvania, Oct. 11, 1859. 8vo, pp. 23.

An address on Evolution and the pathological importance of the lower forms of Life, delivered before the graduating class of the Medical Department of the University of Pennsylvania, May 1, 1886. Reprinted from the Therapeutic Gazette for June 15, 1886. 8vo, pp. 21. George S. Davis, Detroit, Mich., 1886.

Biographical Notices.

Biographical Notice of Joseph Leidy, M.D. By Joseph Parrish, M.D. In the New Jersey Medical Reporter and Transactions of the New Jersey Medical Society, Burlington, N.J. Sept. 30, 1853. [Approved by Dr. Leidy.]

Sketch of Joseph Leidy. By Edward J. Nolan. The Popular Science Monthly, Sept., 1880. [Approved by Dr. Leidy.]

Biographical Sketch of Joseph Leidy, M.D. International Clinics, July, 1891.

In Memoriam. Dr. Joseph Leidy. Personal History. Read at the Academy of Natural Sciences, May 12, 1891. By William Hunt, M.D.

Memoir of Joseph Leidy, M.D., LL.D. By Henry C. Chapman, M.D., Professor of the Institutes of Medicine in the Jefferson Medical College. Proc. Acad. Nat. Sci. of Phila., June 30, 1891.

An Address upon Joseph Leidy, M.D., LL.D. His University Career. By William Hunt, M.D. Delivered Nov. 17, 1891, before the alumni and students of the Medical Department of the University of Pennsylvania.

Brief biographical notices of Dr. Leidy may be found in the following works :

A Critical Dictionary of English Literature. By S. Austin Allibone. 1870.

A Supplement to Allibone's Critical Dictionary of English Literature. 1891.

Dictionary of American Biography. By Francis S. Drake. Boston, 1872.

Appleton's American Cyclopædia, or Popular Dictionary. New York, 1878.

Johnson's New Universal Encyclopædia. New York, 1878.

The Physicians and Surgeons of the United States. By William B. Atkinson, 1878. Also in Second Edition, 1880.

A Biographical Dictionary of Contemporary American Physicians and Surgeons. By William B. Atkinson, 1880.

Universal Pronouncing Dictionary of Biography. By Joseph Thomas, M.D., LL.D. Philadelphia, 1886.

Men of the Times. London, 1887.

Appleton's Encyclopædia of American Biography. New York, 1887.

The Osteology of the Lacertilia.

By E. D. Cope.

(*Read before the American Philosophical Society, March 18, 1892.*)

In the following pages is presented a review of the osteology of the Lacertilia with especial reference to the genera represented in the Nearctic fauna. It is based on the skeletons placed at my disposal by the U. S. National Museum, the Academy of Natural Sciences, and those contained in my private collection. It includes also the record of my observations and notes made in the principal European museums twenty-five years ago. The characters discovered by me at that time, which I found to be of the greatest taxonomic importance, I enumerated in a paper which is printed in the Proceedings of the Philadelphia Academy for 1864, p. 224. The use then made of those characters has been generally accepted by subsequent writers.* There are, however, many other characters whose value is of uncertain taxonomic value, which were not then mentioned, and which I now record.

The first description of the osteology of the Lacertilia is that of Cuvier, which is contained in his Ossemens Fossiles; (Vol. x, ed. 1836). This is an excellent one, but the many types discovered since his time render it necessary that a new survey of the subject should be made. In 1856 the Zootomie der Amphibien, by Stannius, appeared. The account of the osteology of lizards given in this work is more complete than that of Cuvier, but it is incomplete in many points, and is not up to the requirements of the present time. The present study is made with especial reference to the necessities of the paleontology of the order; therefore the description of characters is made as specific as possible. The principal novelty will be found in the references to North American Genera, and in the descriptions of the hyoid apparatus. The description of the scapular and pelvic arches in certain genera with the extremities degenerate or wanting, where they have not been previously described, is contained in a separate illustrated paper now in the hands of the editor of the *American Journal of Morphology* for publication.

SKULL.—The premaxillary bone is single except in the Scincidæ, Acontiidæ, and some Gecconidæ (Phyllurus sp.). It is very small in the Iguanid genus Phrynosoma, and in the Agamidæ it is excluded from contact with the vomer by processes of the maxillaries which meet on the middle line. In the Chamæleonidæ the premaxillary is still smaller, the body being narrower than the superior spine, and supporting but one tooth. In the Anguidæ the premaxillary is bounded posteriorly on each side by a foramen which is sometimes large, which is wanting in other families, including the Helodermidæ. In Lepidosternum it is principally on the inferior

* See Boulenger, Ann. Magaz. Nat. History, 1884, p. 117; and Catalogue of Lizards in British Museum, i, 1885; ii, 1885; iii, 1887. This author has added osteological characters of the Eublepharidæ, Uroplatidæ, Pygopodidæ and Dibamidæ.

face of the muzzle. The nasal bones are generally distinct, but in the Varanidæ they are fused into a single narrow median element. In the Chamæleonidæ they do not attain the nasal border, being cut off by the junction of the prefrontal with the premaxillary and maxillary bones. In the genus Feylinia the nasal bones are fused into a broad plate. In Lepidosternum they are completely cut off from the nasal border by the maxillary, which is broadly in contact with the premaxillary spine. In Rhineüra the nasal bone reaches the nares as in Amphisbæna. The frontal bones are separate in the Varanidæ, Helodermidæ, Anguidæ, Scincidæ, Anelytropidæ, Anniellidæ and Amphisbænidæ, and in some Gecconidæ. They are coössified in some Gecconidæ; in the Iguanidæ, Agamidæ, Xenosauridæ, Eublepharidæ, Chamæleonidæ and Tiidæ. The parietals are generally fused, the only exception being the Gecconidæ, Uroplatidæ, and Xantusiidæ. Prefontals are always present, and in Anniellidæ, Helodermidæ and Chamæleonidæ they extend posteriorly to the postfrontals, excluding the frontal from the orbital border. Lachrymals are present, but they are fused with the prefrontal in the Scincidæ. The jugal is generally present, even when there is no postorbital arch, as in Gecconidæ, where it is a splint; but in the Amphisbænia, Annielloidea, and in Feylinia, the splint-like element attached to the maxillary extends to the pterygoid posteriorly and the prefrontal anteriorly, and may include the lachrymal. The jugal extends anteriorly as far as the lachrymal except in the Scincidæ. The postfrontal is wanting and in most cases is fused with the postorbital in the Varanidæ and Agamidæ; but in other families it is distinct, with sporadic cases of fusion, as in Cnemidophorus. Superciliary bones are present in Varanus, Phrynosoma and several genera of Agamidæ. They belong to the tegumentary system, and articulate, the anterior with the prefrontal, the posterior (absent in Varanus) with the postfrontorbital bone. The supraoccipital is undivided and forms the superior part of the edge of the foramen magnum. Its anterior border is generally loosely articulated with the parietal, joining it by a rudimental or developed median gomphosis with the process supraoccipital. It is generally overhung by the parietal, always so when the parietoquadrate arches are present. It is entirely overrooted by the parietal in the Xantusiidæ, the two elements being connected by a vertical laminiform septum. It is not overhung in the Annielloidea and Amphisbænia, and in these the articulation is a firm complete transverse union. The parietoquadrate arch consists proximally of a process of the parietal, which is directed outwards and posteriorly, which may represent the supramastoid element of the primitive Cotylosauria. Distally this process receives an ascending process of the paroccipital on its inferior aspect, sometimes anteriorly, sometimes posteriorly. This arch is shortened and depressed in the Anelytropidæ and is absent from the Anniellidæ and Amphisbænia. In the Chamæleonidæ it is differently composed, consisting of a superior posterior process of the supratemporal, which rises upwards and reaches the produced apex of the

undivided parietal. The supratemporal is accompanied for a short distance above the quadrate by the ascending process of the paroccipital. The pineal foramen is present in the Chamæleonidæ, Agamidæ, Iguanidæ, Anolidæ, Xenosauridæ, Anguidæ, Lacertidæ, Varanidæ and Scincidæ. It is wanting in the Helodermidæ, Eublepharidæ, Tiidæ, Anniellidæ and in the Amphisbænia. It perforates the parietal bone clear of all sutures in most of the families, but it is near to or on the frontoparietal suture in Iguanidæ and Anolidæ, and is in the frontal in Dipsosaurus and the Chamæleonidæ. The occipital condyle is compound, consisting of portions of the exoccipitals and basioccipital. In many genera these segments become so thoroughly coössified at maturity as to be undistinguishable. In some of the Gecconidæ (as Gecco, Uroplates) the occipital segment is so reduced as to give the appearance of two condyles. In the Amphisbænia the condyle is transverse and concave at the center, leaving the lateral portions prominent.

The postorbital bone when present sends a process posteriorly to the supratemporal, forming the supratemporal arch. In the genera without this arch the postorbital may be wanting, as in Heloderma, or be rudimental as in Anniella. In the genera whose degeneration is advanced, the supratemporal bone is appressed to the parietal, enclosing no *foramen supratemporale*, as in Feylinia. In limbless genera of Anguidæ the supratemporal touches the parietal anterior to the paroccipital, thus reducing the supratemporal foramen. This occurs also in Gerrhonotus, Celestus, Xenosaurus and Xantusiidæ. In Heloderma the supratemporal is a rudiment on the external side of the base of the paroccipital.

The remarkable upward production of the supratemporal in Chamæleon has been mentioned. Here this process takes the place of the parietoquadrate arch. The exoccipitals are produced laterally, each embracing, with the petrosal in front, the small paroccipital. This sustains the superior extremity of the quadrate. In the snake-like genera, as Feylinia, Anniella and the Amphisbænia, this lateral elongation does not exist. The exoccipital is scale-like, and the quadrate is sessile on the side of the skull. The quadrate is generally convex at the upper part of its anterior face, and its external anterior border is produced outwards so as to embrace a longitudinal concavity or conch, with the vertical mass or column of the bone. This column is itself more or less concave, its upper extremity being produced a little backwards. In the Iguanidæ there is another concavity, internal to the column, similar to the external. This is much narrowed in the majority of the families, and in the Varanidæ and Helodermidæ, and in Phrynosoma, Eublepharis, and Celestus it is wanting. In Chamæleon, Anniella and the Amphisbænia there is no external conch, the quadrate being simply a rod; while in Feylinia it is flattened in an anteroposterior plane. The mandibular articulation is more or less bilobate in all except Varanus, where it is plane. In Iguana the bilobation is strongly marked, as in the Permian Theriodonts. The pterygoid bones extend forwards from the quadrates, with which they are

in contact in all forms except Chamæleon, towards the middle line. This portion is generally grooved, but in Xenosaurus it is a slender rod. They are received on the basipterygoid processes of the sphenoid, and then diverge and assume a longitudinal position without meeting on the middle line. They are produced in an angle or process towards the posterior extremity of the maxillary bone, from which they are separated by the ectopterygoid. The pterygoids then join the palatines. In a few genera they bear a few small teeth. The palatines are separate from each other and from the maxillaries, but send a process outwards and forwards to the latter. They join in front each its corresponding half of the vomer. The internal nares are situated each between the vomer and the maxillary, and it notches more or less deeply the palatine, which forms its posterior border. The vomers are separate in all forms excepting Chamæleon, and they have various forms. In Gecconidæ and Anolidæ they are flat and fit closely together, and they have the same character in many Agamidæ and Iguanidæ. In a few members of these families (Uromastix and Sauromalus), they are divided by a groove, which becomes a fissure posteriorly, which is the character in most other lizards. In the Varanidæ each vomer is produced posteriorly on each side this fissure to a greater distance than in other forms. The planes of the palate differ much in different families and groups. Thus the vomer is on a much higher plane than the palatines in Chamæleonidæ and Gecconidæ, the palatines curving downwards to meet the pterygoids. The latter are generally horizontal, but in Chamæleon they are in a subvertical plane, their free rounded extremities descending and fitting on the inner side of the mandible. They do not quite reach the quadrate. In the Agamidæ, Iguanidæ and Gecconidæ the internal extremity of the ectopterygoid is directed inferiorly, forming a downwardly directed angle on each side of the palate. In the Amphisbænia the structure of the palate is much more compact than in other lizards. The palatines are in contact on the middle line and there is no palatomaxillary foramen. That is, the palatine is in close contact with the maxillary, the ectopterygoid being tightly wedged in between them. The pterygoids are in contact throughout their length with the sphenoid, and the proximal end of each is tightly wedged between the latter and the quadrate.

The character of the petrosal must be attended to by any one who desires to understand the relations of the Lacertilia among themselves. In no member of the Lacertilia is the trigeminus foramen closed anteriorly by bony tissue, but it is enclosed by the membrane which forms the anterior wall of the brain case. The petrosal is divided into two parts by the deep notch whose fundus forms the posterior border of this foramen, which may be called the supra- and infraforaminal portions. The infraforaminal portion is divided in most of the families by a longitudinal, keel-like ridge, which forms the superior border of a groove whose inferior wall is formed by the sphenoid. This groove is not present in Heloderma and is very shallow in Xenosaurus. It is wanting in the Anniel-

lidæ and Amphisbænia. In the Gecconidæ it does not exist, nor is the petrosal notched by the foramen, while the anterior border of the petrosal forms a free crest which extends from above downwards and backwards. In the Chamæleonidæ, Agamidæ, Iguanidæ and Anolidæ (families with papillose tongues), the supraforaminal part of the petrosal is short and is bounded by a convex anterior border which marks the position of the anterior semicircular canal. In the Nyctisaura, Thecaglossa, Diploglossa, Leptoglossa and Amphisbænia (families with smooth or squamous tongues, except Anniella, Diploglossa and Nyctisaura) the petrosal is produced beyond this curved border below the parietal. In many forms an outline of the semicircular canal, which forms the boundary in the other superfamilies, may be traced, whence I have termed this part of the petrosal posterior to it "the arched body" in my former system of the Lacertilia.* The petrosal is produced furthest beyond this arcade in the snakelike forms of the Anniella and Amphisbænia, reaching almost to the orbit in Lepidosternum. The relation to the parietal differs, the differences resulting from the greater or less reduction of the primitive supratemporal roof and the greater or less entrance of the parietal into the lateral wall of the brain case. In most of the families it is little or not decurved to meet the petrosal; and in the Iguania, where it is decurved, it does not come in contact with the petrosal owing to the shortness of the latter. In certain families where the petrosal is produced beyond the arcade, and the parietal is decurved, the two elements are in contact for a short distance, as in the Varanidæ. In the Tiidæ and Scincidæ the contact is mainly effected by a short descending process of the parietal. This process is especially elongate in the Scincidæ. The arcade is the anterior border of the petrosal in the Permian Theriodonta, and it marks the position of the anterior semicircular canal. The membranous wall of the brain case, anterior to the petrosal, contains an ossification which is of uncertain homology. It reaches or approaches by its superior extremity the frontal, and might hence be supposed to be the orbitosphenoid; but this homology is vitiated by the fact that its inferior portion passes behind the optic foramen. The latter position is that of the alisphenoid, and so the bone is named by Parker.† But there is another element, the epipterygoid, posterior to it and immediately anterior to the petrosal, which has been supposed to be the true alisphenoid. Leaving this question, and adopting for the bone in question the provisional name of postoptic, I remark that is typically triradiate, sending two branches upwards and one downwards. This is its character in Agamidæ, Varanidæ and Tiidæ. The posterior superior branch is much reduced in many Iguanidæ and Lacertidæ and in some Agamidæ (Megalochilus), and it is absolutely wanting in Gerrhosaurus and Chamæleon. There is nopostoptic in Heloderma. In the Rhynchocephalian genus Sphenodon these two elements coëxist with an orbitosphenoid, lying between the optic and tri-

* Proceeds. Academy Philadelphia, 1864, p. 224.

† Transac. Royal Society, 1879, p. 605, on the "Development of the Skull in Lacertilia."

geminal foramina. The two together may be homologous with the mammalian alisphenoid. The epipterygoid is present in all Lacertilia excepting the Chamæleonidæ and Annulati (Amphisbœnia). Its superior connections are quite characteristic of the different families. Inferiorly it rests on the pterygoid posterior to its ectopterygoid process, excepting in the Gecconidæ, where its point of attachment is opposite to that process. In the same family it does not reach the parietal, but the superior extremity rests on the apex of the supraforaminal part of the petrosal. In the remaining families there are three modes of superior attachment. In most of the Iguania and Acrodonta it reaches the parietal and does not touch the short petrosal. In the other superfamilies it is in contact with the petrosal. In the Varanidæ, Helodermidæ and most Anguidæ it reaches the parietal, which does not meet it with a conspicuous descending process. In Scincidæ and Tiidæ a conspicuous descending process meets it. In a certain number of genera of various families it does not quite reach the parietal. Such are Eublepharidæ, Gerrhosauridæ, Anguis, Lacerta, Phrynosoma (where it rests on the arcade of the petrosal), Iguana, Uromastix, Agama and Gonyocephalus (*suberistatus*). In Lyriocephalus and Phrynocephalus the epipterygoid is very short.

The *semicircular canals* perforate the supraoccipital, the exoccipital and the petrosal. The internal is in a subtransverse vertical plane, causing a convexity on the internal side of the supra- and exoccipitals, and in some types a visible rib on the superoexternal surface of the same. The external canal is in a horizontal plane and perforates the base of the exoccipitopetrosal suspensorium, causing a horizontal rib on the anterior face of the latter in some forms. The anterior is in a vertical anteroposterior plane, and perforates principally the petrosal, occupying its anterior border, which forms the "arcade" in most of the thick-tongued superorders, but crossing the bone much behind the anterior border in the slender-tongued superorders and the Diploglossa. The *fenestra ovale* is tightly closed by the disk of the stapes, which is continued externally as the rod-like columella. This rod is slender except in Anniella, where it is remarkably robust. In the other Amphisbænia its tympanic extremity is somewhat thickened. The columella is continued externally into a cartilage which is more or less expanded in the vertico-transverse plane, the distal portion always so, forming a vertical lamina in contact with the tympanic membrane. This is the epistapedial cartilage. It is frequently produced upwards beyond its point of attachment into a suprastapedial process. The plate thus formed is almost separate from the proximal axial part of the cartilage in Heloderma.* The axial portion has a descending process, the infrastapedial of Parker, in Lacerta, Heloderma, but not in Eublepharis, Thecadactylus and Phyllodactylus.

The rami of the *lower jaw* are united at the symphysis by ligament only. The angle is a prolongation of the articular bone; it is elongate and simple,

* Memoirs U. S. Natl. Academy Sciences, 1884, Vol. iii.

except in Anniella and Chamæleon, where it is absent. The angular bone never reaches the angle, and has an anterior position, being sometimes fused with the articular. The relations of the segments of the lower jaw are very characteristic in the divisions of the Lacertilia. The splenial bone is wanting in the Chamæleonidæ, and is very small in the Agamidæ; in other families it is well developed. The dentary extends posteriorly on the external face of the ramus, as the splenial diminishes, having the greatest posterior extent in the two families mentioned. The coronoid is differently extended in a similar ratio. Thus it is extended posteriorly on the external side of the ramus, and not anteriorly, in the Chamæleonidæ and Agamidæ; both forwards and backwards in the Gecconidæ; and forwards in the other families. The angular is absent (fused with the articular Boulenger) in the Gecconidæ, Anolidæ, Acontiidæ, Anelytropsidæ, Anniellidæ and the Annulata, and is distinct in all other families. The articular and surangular are fused in several genera of Iguanidæ; and there are but three bones in the ramus of Xantusia, q. v. The angular extends well anteriorly on the inferior border of the jaw in this order, but is differently developed on the inner and outer faces. The Chamæleonidæ and Agamidæ again show their similarity in having this element chiefly exposed on the interior side, while in other types the exposure is external. The Meckelian groove is open in the Chamæleonidæ, Agamidæ and Varanidæ, but is roofed over more or less completely in all other families.

The *hyoid system* is not connected with the skull except in Gecconidæ, Eublepharidæ and Lepidophyma, so far as I have examined them. Thus in Thecadactylus, Phyllodactylus and Eublepharis, the ceratohyal is continuous with a cartilage which projects from the paroccipital above the posterior part of the auditory meatus. In Lepidophyma the free epibranchial is attached to the inferior lateral angle of the basioccipital. In forty-two genera of other families enumerated below, this is not the case. In no genus have I discovered any connection with the stapedial cartilages. The hyoid system in lizards consists of a glossohyal which is continuous with a basihyal tract; a hypohyal often continuous with the basihyal tract; a ceratohyal; a first ceratobranchial, and a second ceratobranchial which is always continuous with the basihyal tract. There may be in addition an epibranchial, which belongs to the first ceratobranchial. In some genera, there is a free epibranchial, which may be then closely approximated to the ceratohyal (Eumeces, Oligosoma, Gerrhonotus), or to the second ceratobranchial (Lacerta, Xantusia, Lepidophyma). The only constantly ossified element is the first ceratobranchial. The genera and families differ in the presence or absence of the second ceratobranchials and epibranchials; and the proximity or separation of the former. In general the Varanidæ, Anguidæ, Zonuridæ, Gerrhosauridæ, Scincidæ, Lacertidæ and Xantusiidæ have epibranchials, while the thick-tongued and most degraded types are without them. In the Tiidæ the hypobranchials are much produced anteriorly beyond the bases of the ceratohyals, and there are no second ceratobranchials. In Anguidæ the

hypobranchials are also greatly produced forwards, but carry the ceratohyals with them. Ceratobranchials of the second pair are also wanting in Varanidæ, Helodermidæ, Chamæleonidæ, Anguidæ, Anniellidæ and Rhineura; Phyllodactylus, Thecadactylus and Gecko, among Gecconidæ; and Egernia and Gongylus in Scincidæ. Ceratohyals are wanting in Chamæleon, Anguis, Anniella and Annulata generally. In both Agamidæ and Iguanidæ the second ceratobranchials are separated from each other in the depressed genera of terrestrial habits, and in close contact with each other in those of arboreal habits; but they are in close contact in Callisaurus and Crotophytus, both terrestrial genera. In Calotes, Iguana and Anolis they act as the rim on which the gular pouch or fan is stretched. The characters of Lacertilian hyoids may be tabulated as follows: Most of the genera referred to are figured in Plates iii to vi.

I. Ceratohyal present. II. Ceratohyal absent.

A. A second ceratobranchial.

a. Free epibranchials present.

Scincidæ.
Lacertidæ.
Xantusiidæ.

aa. No free epibranchials.

(Scincidæ) ***Mabuia agilis; Gongylus ocellatus.***
Anolidæ.
Iguanidæ.
Agamidæ.
Zonuridæ.
Eublepharidæ. Chirotidæ.



often splits the base and sometimes the length of the diapophysis. Such a structure is seen in Iguanidæ (Iguana Sauromalus Sceloporus Dipsosaurus); Anolidæ; Anguidæ (Celestus); Tūdæ (Tupinambis Cnemidophorus); Lacertidæ (Lacerta) and Scincidæ (Gongylus Eumeces). In Dipsosaurus, Anolis and Lacerta, the neural spines of the caudal vertebræ are double; in the other genera named, single. In Varanidæ, Helodermidæ, Gerrhonotus, Crotaphytus and Phrynosoma, the caudal centra are undivided, and the neural spines are single. In Ophisaurus the centra are undivided and the neural spines double. The centra are excessively thin in Ophisaurus, so that they break more readily than they disarticulate. There are two sacral vertebræ except in genera with the posterior limbs rudimental or absent. In some of these however, especially the degenerate genera of the Anguidæ, the rudimental ilium is attached to two diapophyses which join each other distally.

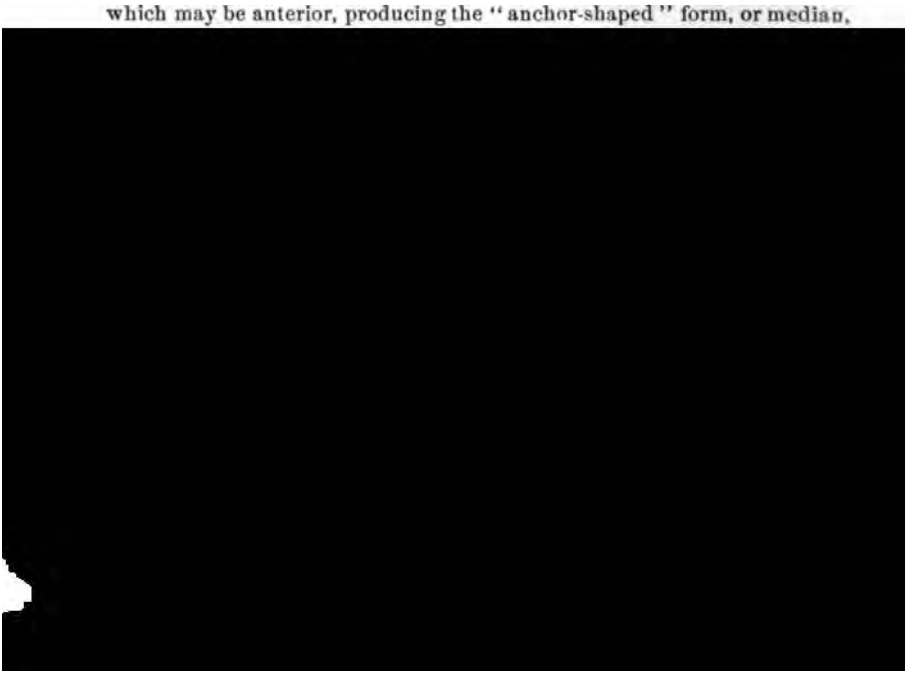
The first dorsal vertebra is that one which is first connected with the sternum by a hæmapophysis. In genera with a well-developed sternum, the number of vertebræ anterior to the first dorsal is eight, except in the *Varanus niloticus* (Cuvier) and *V. griseus*, where it is nine. In the extinct Dolichosauria of the Cretaceous period, the cervical vertebræ are stated by Owen to number seventeen.

The number of ribs attached to the sternum diminishes with the reduction of the limbs, from the normal number of four on each side to one, and total disconnection. A common hæmapophysis or "xiphoid rod," succeeds these on each side, which gives attachment to two separate hæmapophyses for ribs. The common hæmapophysis is a segmentation of the anterior part of the fifth hæmapophysis, and it is not distinct in some genera, as *e. g.*, Sauromalus. In Heloderma, the fifth hæmapophysis has no sternal segment or connection, and the sixth is wanting. In Varanus the fourth, fifth and sixth are wanting. In genera with the two appendicular hæmapophyses, they are closely appressed on the middle line in the majority of the genera, but in genera of depressed form, they are separated often widely. They are separated in *Stenodactylus guttatus*, in Phymaturus, Crotaphytus and Sceloporus. They are more widely separated in Dipsosaurus, and most widely in Sauromalus and Phrynosoma. Cervical ribs are present in varying numbers, and the posterior ones are generally quite elongate. In certain genera and families the ribs posterior to those attached to the sternum have their hæmapophyses fused on the middle line below, thus constituting a series of abdominal ribs. In the Iguanid genus Scartiscus there are two such ribs. In the Anolidæ there are four and five pairs; in the Polychroine Iguanidæ there are seven to ten. In the Chamæleonidæ and Gecconidæ there are several pairs. The ribs of Lepidosternum are remarkable for the presence of a capitular process, which has no distinct capitular articulation.

3. Scapular Arch.—The clavicle is present in all the families except the Chamæleonidæ, and in certain genera with degenerate fore limbs. In such genera it is the last portion of the scapular arch to remain, and it is

the only element present in Feylinia (Anelytropsidæ). It is always osseous. The form of its proximal extremity varies in the different families. It is simple in the Nyctisaura, Uroplatoidea, Acrodonta, Iguania, Diploglossa and Thecaglossa; and expanded and generally perforate in the other superfamilies where present, except in some degenerate genera where it is simple (see Plate ii, Fig. 2). In Trachysaurus and Cophias, its proximal end is dilated but not perforate. The scapula varies in form from elongate to short and wide. It presents a proscapular process in many families and genera. It is present in Iguania and Nyctisaura; in the last named often decurved and acuminate; and in Lophura, in Acrodonta. It is present among Leptoglossa in Cnemidophorus, and in some Amivæ, while in other Amivæ it is wanting. It is wanting generally in Acrodonta, Diploglossa, Thecaglossa and Leptoglossa, but it is present in *Celestus striatus*. It is wanting in Rhiptoglossa. The coracoid is extended anteriorly to the sternum, and it is generally deeply emarginate on its anterior interior border. These emarginations are closed by the procoracoid, which extends to the middle line, and is only partially or not at all ossified. There are two coracoid emarginations in most Iguania; exceptions being the terrestrial genera Urocentrum, Sceloporus and Phrynosoma, and the Anolidæ. There are also two in Varanidæ and Tiidæ. The Agamidæ generally have but one, but Uromastix is an exception. There is but one in Anguidæ and Scincidæ (two in Tiliqua); and none in Helodermidæ and Chamæleonidæ.

The interclavicle is a very characteristic element in the Lacertilia. It is wanting in Chamæleonidæ and in some genera with fore limbs rudimental or absent. It is a simple splint in Helodermidæ and some degenerate genera. In other families it has a transverse limb on each side, which may be anterior, producing the "anchor-shaped" form, or median,



are well developed. The latter are only separated from each other by ligament or cartilage, which may sometimes contain some lime salt. It is produced posterior to the ischia in a triangular process, and less frequently into a similar one in front of the pubic symphysis. The pubic foramen is always present. The pectineal process is present except in Gecconidæ, but it is rudimental in some forms, as Phrynosoma. The following table shows the forms of the pubis in twenty-three genera of different families:

I. Pubes uniting at an acute angle.

1. Pectineal process anterior..... .... *Chamæleon.*
2. Pectineal process median..... *Calotes, Draco,*
Iguana Dipsosaurus Anolis,
Gerrhonotus,
Tupinambis Cnemidophorus.
3. Pectineal process near acetabulum ..... *Scincus,*
Lacerta,
Eumeces (rudimental).
4. No pectineal process..... *Gonyocephalus.*

II. Pubes uniting at an obtuse or very open angle.

1. Pectineal process median..... *Iguana Cyclura Crotaphytus,*
Histiurus.
2. Pectineal process near acetabulum..... .....*Agama,*
Phrynosoma Sauromalus Sceloporus,
Heloderma,
Varanus.
3. Pectineal process none..... *Gecko* (*Phrynosoma*, rudiment).

There is a tuber ischii in all of the genera which have come under my observation except Varanus. In Heloderma and some other forms it is small.

5. The Anterior Limb.—The humerus is much alike in all Lacertilia, Chamæleo only presenting peculiarities. The proximal end is expanded nearly in one plane, and the middle portion of the flattened extremity forms the oval head. This is not distinctly isolated, except by the presence of articular surface, from the greater and lesser tuberosities which occupy the angles of the expansion. The shaft betrays no twist. The distal end is chiefly occupied by the condyles; but there are epicondyles, of which the internal is the more prominent, except in Chamæleon, where they are wanting. The condyles consist of an external rib and a medio-internal roller, which is generally bounded at the internal extremity by a tuberosity, which is, however, wanting in Chamæleon. The ulna articulates with the median roller, its external edge being beveled by the external rib. The head of the radius articulates with the external rib, having shifted from its primitive position on the inner side. It results from this that in pronation the radius crosses the ulna. There is a short ole-

cranon except in Chamæleon. The ulna and radius have about an equal share in the carpal articulation, sometimes the ulna a little the greater.

The constitution of the carpus is very uniform in Lacertilia with developed anterior limbs, the principal diversity being displayed by the Chamæleonidæ. In all, we have in the proximal row three distinct elements, the radiale, intermedium and ulnare (=pisiforme), the latter mainly external to the ulna and directed posteriorly. Distal to the radiale and intermedium, and between them and the carpalia of the second row, is a single small centrale. There are five carpalia, each corresponding to a metacarpal. I have failed to find in any of the genera at my disposal any of the carpalia fused together or wanting. In Chamæleon, on the contrary, Cuvier has shown that there is no ulnare, and that the centrale and carpalia are fused into a single round median piece, to which the metacarpals are articulated. In all the normal Lacertilia the tendons of the flexors of the digits are combined on the palm, and the point of junction is occupied by a large flat sesamoid bone. The number of phalanges is also remarkably uniform. They number in each digit, commencing with the pollex, 2-3-4-5-3. The sole exception in the genera with well-developed extremities is Chamæleon, where the numbers are 2-3-4-4-3. This genus differs also from other forms in the shapes of the metacarpals. Normally they are cylindric and subparallel in position and united in a common integument; but in Chamæleon they are flattened, with expanded extremities, and divided into two bundles by a fissure, three within and two without, enabling the three inner digits to oppose the two outer round a branch of a tree. The number of digits in Lacertilia is normally 5-5, but reductions take place presenting variations from 4-5 to 1-1, the posterior limb usually displaying a lesser degree of degeneracy than the anterior, although not always.

6. Posterior Limb.—The femur differs from the humerus in having a distinct head, which is marked off from a trochanter. The former is not hemispherical as in Mammalia, but is somewhat compressed, and is oval in section. The trochanter is on the inferior anterior side of the head, or in the position of the little trochanter of the Mammalian femur. There is no great trochanter, nor third trochanter. The condyles of the femur are not as well defined as in the Mammalia, and the patellar groove is represented by a shallow concavity without lateral ridges. Patella none, with some exceptional rudiments, as in Varanus, *e. g.* In Chamæleo all the prominent features of the femur are toned down; the trochanter being represented by a ridge. The fibula is more slender than the tibia, and is larger distally than proximally, the reverse of what obtains in the tibia. The latter has no crest.

Like the carpus, the tarsus is very uniform in the Lacertilia, the sole important modification being exhibited by the Chamæleonidæ. There are two fused proximal elements, which are probably tibiale-intermedium and fibulare. They are only distinct in Heloderma among North American genera, but a trace of the suture is seen in Varanus. In most Lacertilia

there is then, but one bone of the proximal row, which is flat and wider than long. No centrale, and but two tarsalia, the third and fourth, the latter much the larger. The second metatarsal projects alongside of t. iii, so as to approximate the tibiale; its head is figured by Cuvier as a distinct bone, but he does not describe it as such. In Chamæleon there is a single proximal tarsal element, which is not flattened as in other lizards, and this articulates with a single subglobular tarsale, from which the metatarsals radiate.* The phalanges number, like those of the anterior foot, 2–3–4–5–3, in ordinary Lacertilia, and 2–3–4–4–3 in Chamæleonidæ.

Phyllodactylus Gray.

In their osteology the species of this genus conform strictly to the Gecconid type as already described. I have before me the skeleton of *P. tuberculosus*, from which the following description is derived. The premaxillary is single and has a long superior spine; inferiorly it has the posterior border emarginate. Nasals elongate, distinct, emarginate posteriorly for the frontal. Frontal single, rather narrow, completely underarching olfactory lobes. Parietals distinct, wide, without pineal foramen, lying rather closely on supraoccipital, sending backwards the parietoquadrate arch, which encloses a small foramen with the exoccipital. Supraoccipital distinguished from exoccipital by suture. Prefrontal narrow, forming the preorbital border to the middle above; no lachrymal; jugal represented by a splint which extends from the prefrontal to the extremity of the maxillary on the superior surface of the latter. Postfrontal a rather wide V-shaped bone, its longest limb extending posteriorly more than half way to the base of the parietoquadrate arch. No postorbital. Quadrate with a single large, concave, external conch. Paroccipital in the usual position, splint-like.

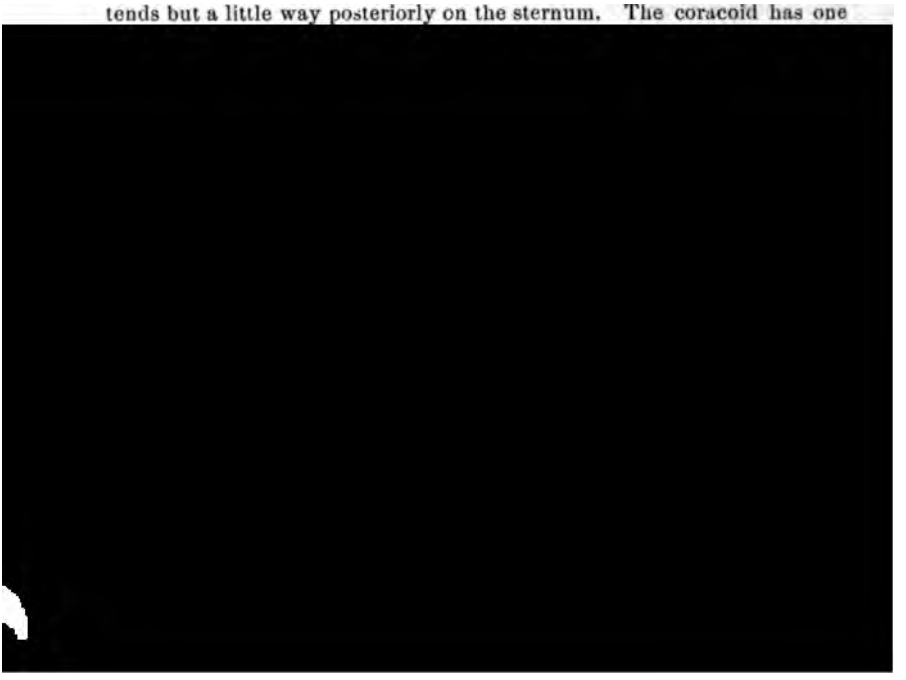
Vomers in close contact throughout, with a common convex posterior border; an external longitudinal convexity of the inferior surface, and a groove on each side of the median suture, which divides a keel. Palatines short and wide, and with a longer vomerine than maxillary process, and curving downwards below the level of the vomers. Nareal orifices fissure-like except posteriorly and anteriorly, the external border with a dentate process of the maxillary bone directed posteriorly near the middle. Pterygoids much expanded anteriorly, forming with the ectopterygoids and palatines a thin plate, which closes up the palatine foramen; contracting rather rapidly posteriorly to the subcylindric rod-like portion. Epipterygoid extending from the pterygoid at the basipterygoid process, and resting on the apex of the petrosal. Latter produced above

* Cuvier (Ossemens Fossiles, ed. 1836, p. 98) describes a distinct tibiale and fibulare in Chamæleo, and figures them (Plate 245, Fig. 52). These are not represented by Boulenger (Proc. Zoöl. Soc., London, 1891, p. 118). They are in fact not distinct tarsal elements, but are the epiphyses of the tibia and fibula such as exist also in Heloderma and other genera. The tibiale and fibulare are fused into a single element as in other Lacertilia.

anterior to semicircular canal; the anterior border continued into a crest which runs posteriorly above the trigeminal foramen. This terminates at the down-looking crest of the subforaminal portion, which bounds externally a wide down-looking groove. Basipterygoid processes long. Sphenoid distinct from basioccipital. Occipital condyle subequally divided into three parts, two prominent exoccipitals and a contracted basioccipital. The result is an apparently double condyle.

Mandible with the Meckelian groove closed, and with the splenial small and but little produced beyond the splenial foramen. Coronoid produced a little horizontally at the base. Angular not distinct; surangular and articular distinct. Angle simple, direct, spoon-shaped, with superior concavity. I have observed the following peculiarities in the otic and hyoid regions. There is no infrastapedial cartilage, and the suprastapedial and epistapedial cartilages are continuous. The hyoid system is characterized by the fact that the ceratohyal is attached to the paroccipital, which carries a cartilage on its extremity. There is a short second ceratobranchial, and no free epibranchial.

Vertebræ amphicœlous. Intercentra present throughout the vertebral column, continued into chevrons on the caudal region. Cervical ribs widened and truncate at extremities. In the specimen described the diapophyses of the second sacral vertebra are deeply longitudinally grooved on the inferior side so as to be nearly split. Diapophyses of anterior caudals elongate. Neural spines distinct but low throughout the column. In the scapular arch I note the following peculiarities. There is no proscapula, and the clavicle is much enlarged, and is perforate at the median extremity. The interclavicle is cruciform with the angles filled up so as to have concave borders. It is coössified with the clavicle in *P. tuberculatus*, and extends but a little way posteriorly on the sternum. The coracoid has one



are coössified and the interorbital space is very narrow. The parietals are coössified and there is no pineal foramen. The supraoccipital is loosely articulated anteriorly, but is coössified with the exoccipitals. No lachrymal bone; prefrontal large but not reaching far posteriorly over orbit. Postfrontal small, crescentic; no postorbital. No postorbital or supratemporal arches. Parietoquadrate arch depressed; paroccipital lying over the parietal at the inferior extremity. No jugal bone. No orbitosphenoid; the olfactory lobes enclosed below by the frontal bone. Petrosal produced beyond semicircular canal at the superior anterior angle, and without the oblique crest such as is characteristic of the Gecconidæ. A subforaminal projection and groove, the external wall of the groove as prominent downwards as the internal, so that the groove is open inferiorly. Vomers swollen, separated for most of their length by a deep groove. Palatines short and wide, sending a postnareal process to the maxillary. Pterygoids broad and flat in front, narrower posteriorly, with a short ectopterygoid without descending angle, enclosing a maxillopalatine foramen. Basipterygoids elongate. Sphenoid and basioccipital distinct; the latter distinct also from exoccipitals. Occipital condyle convex, without exoccipital portion. Epipterygoid oblique, articulating below posterior to ectopterygoid process of pterygoid and above with petrosal only. Quadrate straight, oblique, with a single conch, which is external to the rod-like axis; condyle emarginate. In the mandible the angular bone is small but distinct, and the coronoid is produced much further anteriorly than posteriorly on the external face of the ramus. The dentary extends to about opposite the middle of the coronoid on the external face of the ramus. The splenial extends posteriorly but not anteriorly. The Meckelian groove closed. In the hyoid apparatus all the elements are present, including a pair of elongate second ceratobranchials. There is a free process of the ceratohyal anterior to its junction with the hypohyal.

The scapular arch is much like that of the Gecconidæ. The clavicle is expanded and perforate proximally. The interclavicle is subcruciform with the limbs connected by laminate expansion. There is a small proscapula which is connected at its apex with the epicoracoid. Coracoid with one large emargination. Sternum without fontanelle, supporting three ribs and a ziphoid rod, which supports but one rib. No abdominal ribs.

Anolis Daudin.

The following osteological description is taken principally from the *A. carolinensis*, but other species which I have examined do not differ from it.

Premaxillary with long superior spine, and no inferior spine, but a notch. Nasals distinct, separated by premaxillary spine. Frontal and parietal bones each undivided, the pineal foramen on the coronal suture. Prefrontal large, not extending over orbit; lachrymal narrow, in contact with jugal. Postfrontal small, distinct; postorbital large. Supratem-

poral slender, forming the greater part of the supratemporal arch, its anterior extremity in contact with the postorbital and postorbital process of jugal bones. Paroccipital small; parietoquadrate arch well developed. Supraoccipital loosely attached, coössified with exoccipital.

The frontal bone is grooved on the median line below. The postoptics are within the epipterygoids, and are curved, enclosing a subcircular space, and have a short external branch. The epipterygoid leaves the pterygoid behind the ectopterygoid process, and articulates with the parietal, passing some distance in front of the petrosal. The petrosal is very short above; the subforaminal process is distinct, and the inferior groove looks outwards as well as downwards. Quadrate with wide external conch and no internal conch. Stapes not deeply sunk; columella slender. The vomers are flat and elongate, and are not separated by a groove. The palatines are broad and flat, and the maxillopalatine foramen is small. The pterygoids are broad and flat in front, and are then abruptly contracted from the outside to a narrow posterior part. This curves outwards from the long basipterygoid processes to the quadrate. The ectopterygoids are short and are deflected at the proximal extremity. Presphenoid long and rod-like. Occipital condyle convex, simple, without exoccipital divisions.

The mandible has marked peculiarities. The Meckelian groove is closed, and the splenial bone, if present, is minute. I do not detect it in the *A. carolinensis*. There is a fossa on the inside of the ramus at the base of the coronoid. The latter bone is developed much anterior to its apex on the external face, and not posteriorly. The dentary is produced far posterior to the coronoid. The angular and articular are fused, and the angle is rather short and has an internal angular projection



is but one neural spine. The chevron bones are attached at the extremity of the centrum.

The pubes unite at an acute angle, and have well-developed pectineal process at the middle of their length. The ischia have a prominent tuber.

The premaxillary and anterior maxillary teeth are simple; the others are tricuspid.

Dipsosaurus Hallow.

The osteology of this genus presents a number of interesting peculiarities which constitute difference from Crotaphytus, to which its general appearance suggests affinity.

Premaxillary bone with elongate superior spine, and posterior emargination of inferior face. Nasals large, distinct, not shortened in front, since the nostrils open forwards. Frontal narrow, entire, grooved on the middle line below, its posterior region pierced by the pineal foramen which is entirely anterior to the coronal suture (*D. dorsalis*). Supraoccipital loosely articulated anteriorly, and not distinct from exoccipitals. Prefrontals large, not extending over orbit; lachrymal smaller, touched by jugal. Postfrontal small, distinct from the large postorbital. The latter articulates extensively with both the jugal and supratemporal. Paroccipital small. Parietoquadrate arch well elevated. The vomers together as broad as long, not produced posteriorly, with a median fossa. Palatine flat, with a short maxillary process; pterygoid flat in front, concave on the inner side behind for contact with the long basipterygoid process. Ectopterygoid decurved at its inner extremity. Quadrate with a narrow internal and a wide external conch. Postoptic an open sigmoid, reaching frontal above, with a median expansion with rudiment of posterior limb. Petrosal very short above; subforaminal portion prominent, with a wide inferior groove looking downwards. Epipterygoid leaving pterygoid behind ectopterygoid process, and reaching parietal without contact with petrosal. Presphenoid rudimental; sphenoid and basioccipital united, and with prominent lateral edges. Occipital condyle with exoccipital elements feebly distinguished.

In the mandible the Meckelian groove is completely curved. The coronoid has little horizontal extent, and that is principally anteriorly on the external side. The surangular and articular are fused together, and the splenial is small. The dentary extends as far posteriorly as the posterior border of the coronoid. The angle is prominent, flattened so as to be horizontal, and has an internal angle.

The scapula has a large proscapula directed upwards, and the coracoid has one emargination, which is large. The sternum has a narrow median fontanelle which is not covered by the interclavicle. There are four pairs of ribs articulated to the sternum, and two continue into the approximated xiphoid rods. The ribs reach the sacrum.

Vertebræ with a zygosphen articulation. Eight cervical vertebræ, the anterior with a compressed hypapophysis, which soon becomes a keel, which is absent on the eighth cervical and all following vertebræ. Four anterior vertebræ without ribs; seventh and eighth with long ribs. Diapophyses very short, except in the caudal region, where they are present for half its length, increasing in length to the base where they are quite elongate. Chevron bones intercentral. Neural spines of dorsal region low, of caudal region rather elevated, oblique, and preceded by a compressed vertical prominence or anterior neural spine. The centra are transversely segmented just in front of the diapophysis, except in the anterior part of the series.

The angle of junction of the pubes is nearly right, and the pectineal process is median, short and decurved. The ischia have a long common suture, and are deflected downwards, meeting at less than a right angle. Tuber a prominent angle. The ilium presents a short subacute angle representing the *crista*. There is a deep posterior notch of the acetabulum.

In *Dipsosaurus dorsalis* all the teeth on the maxillary bone are tricuspidate; those on the premaxillary are mostly simple, but one or two external ones show a rudimental lateral cusp.

Crotaphytus Holbrook.

The skeletons of the two most abundant species are before me, viz., the *C. collaris* Holbr. and *C. wislicenii* B. & G. The following description includes both, and if any differences between the two exist, they are mentioned.



pterygoid processes. Ectopterygoids depressed internally. Epipterygoid originating behind ectopterygoid process, and reaching parietal without contact with petrosal. Presphenoid rudimental; sphenoid and basioccipital confluent. Occipital condyle plain, with exoccipital elements not distinct. The fenestra ovale and foramen of viii nerve sunk in deep fossæ.

In the mandible the terminal part of Meckel's cartilage is exposed. The coronoid has no extension on the external face, and extends a short distance forwards on the inner face. The splenial is rather elongate, and extends anterior to the splenial foramen. The dentary extends to the line of the posterior border of the coronoid above, and of its anterior border below. In old individuals the surangular and articular are fused. The angle is pinched, and sends inwards a horizontal process similar to its posterior process.

In the hyoid apparatus the ceratobranchials of the second pair are closely appressed, thus supporting a median gular angle. The hypohyals are moderately long, and they join by their extremities the ceratohyals, which have no expansions, and are of only moderate length.

The scapula has a well-developed proscapula, and there are two deep emarginations of the coracoid. The sternum has a narrow longitudinal median fontanelle in the *C. collaris*, and no fontanelle in *C. wislicenii* (one specimen of each examined). There are four ribs articulating directly with the sternum on each side, and two via each xiphoid rod. The latter are not closely appressed as in some, nor so widely separated as in other Iguanidæ.

Vertebræ without zygosphenal articulation, but the prezygapophyseal faces concave. Cervical vertebræ eight, the anterior five vertebræ with six free intercentra in *C. wislicenii*, and four vertebræ with five intercentra in *C. collaris*, anterior three vertebræ without ribs in both species. The neural spines are very low on the dorsal vertebræ, and are a little more elevated on the caudals. The latter have a projecting keel towards the anterior part in the *C wislicenii* (wanting in *C. collaris*), which represents the anterior neural spine of *Dipsosaurus dorsalis*. The centra in Crotaphytus are not segmented. Diapophyses are present, but are nowhere long. Short ribs extend to the sacrum.

The teeth are tricuspid, but in the two species examined the lateral cusps are rudimental. Anterolateral and incisor teeth simple, subequal.

The pubes unite at an exceedingly open angle, and the pectineal process is submedian. Tuber ischii prominent; a small angle or crista ilii. Acetabulum entire posteriorly.

The principal characters in which the skeleton of the Crotaphytus differs from Dipsosaurus are the following: Nasal bones shortened in front; no postfrontals; pineal foramen connected with coronal suture; Meckelian canal partly open; two notches of coracoid; xiphoid rods not appressed; no zygosphen; caudal centra not divided; acetabulum not deeply notched.

SAUROMALUS Duméril.

The following description of the osteology of this genus is based on a skeleton of the *S. ater*, belonging to the National Museum.

The premaxillary has a long spine above and a transverse posterior border below with the anteriorly directed button process. The nasals are well developed and distinct in spite of the large size of the nares. Frontal entire, rather narrow, grooved on the middle line below, and including pineal foramen, which touches the coronal suture. Parietals divided perhaps abnormally in specimen. Supraoccipital loosely attached, but fused with exoccipitals. Prefrontals large, not extending over orbits; lachrymals small, in contact with jugal. Postfrontal distinct, small. Apex of postorbital cartilaginous, inferior face in long contact with jugal and supratemporal. Paroccipital not large; parietoquadrate arch well separated from exoccipital. Postoptic not reaching frontal, superior extremity expanded backwards and forwards. Petrosal very short above, prolonged below, inferior groove looking laterally. *Fenestra ovale* and *foramen nervi octavi* sunk in deep fossæ. Vomers entirely separated from maxillaries, not produced, but separated by a groove behind. Palatines with a short maxillary process. Palatine foramen moderate; pterygoids divaricating from each other outwards. Ectopterygoid produced downwards at the posterointernal angle. Pterygoids grooved from basipterygoids backwards on internal side. Quadrate with two conchs, the internal one flat. The epistapedial cartilage is largely ossified.

Presphenoid a slender rod; sphenoid and basioccipital confluent. Occipital condyle with exoccipital elements slightly marked above.

In the mandible Meckel's cartilage is completely enclosed. The splenial is produced but little beyond the splenial foramen. Coronoid extended a



the anterior end, where it is elevated into a low anterior spine. Chevron bones intercentral. Four sternal ribs and two from the xiphoid rod.

Scapula very short, with a large superior proscapula. Coracoid with two notches. Sternum wide and emarginate posteriorly, spreading the xiphoid rods far apart. No fontanelle.

Pelvis with the pubis transverse and the pectineal process external. Ischia rather slender, with a short symphysis, and each with a long tuberosity.

This genus is remarkable for the combination of characters it displays. The zygosphenal articulation allies it to Dipsosaurus and the larger Iguanidæ, but the separated ceratobranchials, and the wide sternum are like that of the Phrynosomas, with the exception of the fontanelles. The transverse pubes have a similar significance.

Sceloporus Wiegmann.

As a basis for an examination of the osteology of this genus I have before me two skeletons of the *S. undulatus* and one of the *S. spinosus*, from the National Museum.

The premaxillary bone has a long superior spine, and is truncate on the palatal face, and has the button-like process. The nostrils are partially vertical so that the nasals are a little shortened in front. The latter are rather large and are distinct. The frontal is simple and narrow, and is strongly grooved on the middle line below. The parietal is short and wide, and is perforated by a large pineal foramen which touches the coronal suture. Parietoquadrate arch distinct. Supraoccipital broadly but loosely attached, confluent with exoccipitals. Prefrontals large, not reaching postfrontals above; lachrymal small and joining jugal. Postfrontal a small splint; postorbital large, extensively in contact with jugal and supratemporal. Paroccipital small. Vomers short, divaricate and separated by a deep notch behind. Palatine with the vomerine process longer than the maxillary; palatine foramen large. Palatines and pterygoids well separated from each other on the middle line; ectopterygoid deflected at its internal extremity. Basipterygoids developed. Quadrate with two conchs, the internal the narrower. Presphenoid rudimental; sphenoid and basioccipital coössified; descending lateral processes of the latter strongly developed. The supraforaminal part of the petrosal is very short; the infraforaminal portion is produced beyond it and is nearly horizontal in position. The *foramen nervi octavi* is at the bottom of a fossa. Epipterygoid resting on pterygoid much posterior to ectopterygoid and reaching parietal without touching petrosal. Occipital condyle not subdivided by grooves.

The hyoid system includes a pair of well-separated short second ceratobranchials, and rather long and slender first ceratobranchials and ceratohyals, which have no expansions. Hypobranchials moderate, supporting ceratohyals at extremities.

Mandible with Meckel's cartilage exposed at the distal part. Coronoid

not horizontally produced on external face. Articular and surangular united. Splenial moderately elongate; dentary extending behind coronoid on external face and deeply notched. Angle short, horizontal, with short internal angle. Five cervicals with intercentra in *S. undulatus* and six in *S. spinosus;* three without ribs in both. Ribs extending to sacrum. Sacral centra not coössified. Sacral diapophyses coössified distally; the second with a posterior free angle distally. Caudal diapophyses well developed at base of tail. From about the eighth caudal the centra are segmented in front of the middle.

Scapula with proscapular process; coracoid with one notch. Sternum with a very large fontanelle. Two ribs join the sternal plate; one comes off the base of the xiphoid rod, and two articulate with the latter; total, five pairs. The ilium has a small *angulus cristæ*, and the acetabulum is not emarginate behind. The pubes are nearly transverse, and the pectineal angle is external. The ischia are rather slender, and the tuber is an angle.

The middle and posterior teeth are feebly tridentate; the others are simple.

Phrynosoma Wiegmann.

The following account of the osteology is derived from the skeletons of three species, the *P. douglassii*, *P. cornutum* and *P. coronatum*. The description applies equally to each of these species unless otherwise stated.

The premaxillary has a very short alveolar portion which does not bound the nostrils below (or very little *P. coronatum*). It has a superior spine and concave palatal border. The nasals are distinct and are excavated in front by the large nareal openings. The frontal is single, is much narrowed in front by the prefrontals, but extends transversely posterior to the orbits, where it sends forwards an acute process in the super-

are three on the supratemporal; and in *P. douglassii* the arrangement is similar. Owing to the inferior position of the supratemporal, the quadrate is oblique forwards and downwards. It presents one conch, the external. The vomers are short, and are separated from each other for the posterior half or more of their length by a hiatus, which continues posteriorly of about equal width between the palatine and pterygoid pairs. The latter are short, wide and flat, and the palatine foramen is small; least and oval in *P. coronatum;* small and round in *P. cornutum;* larger and elongate in *P. douglassii.* The ectopterygoid is decurved at its inner extremity. The presphenoid is wanting, and the suture between the sphenoid and the basioccipital is persistent. The supraforaminal part of the petrosal is very short, and the infraforaminal part is not much produced, and has a wide inferior groove. The epipterygoid originates behind the ectopterygoid process, and has the peculiarity among Iguanidæ of not reaching the parietal, but of resting on the anterior border of the petrosal. The occipital condyle shows traces of its tripartite composition. The postoptic is curved and simple and does not reach the frontal bone. The latter is grooved on the middle line below.

The groove of Meckel's cartilage is open throughout in *P. cornutum* and *P. coronatum* and distally only in *P. douglassii.* The coronoid is not produced horizontally on the external face of the mandible, and the dentary is not produced beyond its posterior border. This element has a reflected inferior border in the *P. cornutum* which is acutely dentate posterior to the middle; characters absent from *P. coronatum* and *P. douglassii.* In *P. douglassii* the surangular is not coössified with the articular, while it is so united in the other two species. The angle is short, and is directed downwards and obliquely inwards.

The basihyal is wide and is ossified, and the second ceratobranchials are very short and widely separated. The hypohyals are short and carry the ceratohyals on their extremities. No expansions of lateral elements.

The vertebræ have no zygosphen articulation, but the prezygapophyseal facet is carried upon the side of the neurapophysis at an angle with the usual position. This furnishes the initial step in the production of a zygosphen. I find five cervical intercentra in *P. cornutum* and *P. coronatum,* and six in *P. douglassii,* exclusive of the intercentrum of the atlas, which has no hypapophysis. Ribs extend to the sacrum, and are attached to very short diapophyses. The two sacral diapophyses are separated by a wide fissure in the *P. coronatum* and *P. douglassii,* but are closely appressed in *P. cornutum.* On one side of the skeleton of *P. douglassii* the last lumbar vertebra carries, abnormally, a third sacral diapophysis which reaches the ilium. Proximal part of caudal vertebræ with long diapophyses. Caudal centra not segmented. Chevron bones intercentral, *not uniting distally.* Neural spines everywhere very low, those of the caudal vertebræ single.

The suprascapula is exceptionally elongate, and the scapula is of moderate length and has a proscapular process. The coracoid has one emar-

gination. The interclavicle is remarkable for the shortness of its posterior limb, which is shorter than the transverse limb in *P. cornutum* and *P. douglassii*, and equal to it in *P. coronatum*. The sternum has a very large fontanelle which approaches the posterior border. In *P. coronatum* and *P. douglassii* three ribs articulate with the sternum, but in *P. cornutum* two only in my skeleton. The xiphoid rods are widely separated, and carry but one rib.

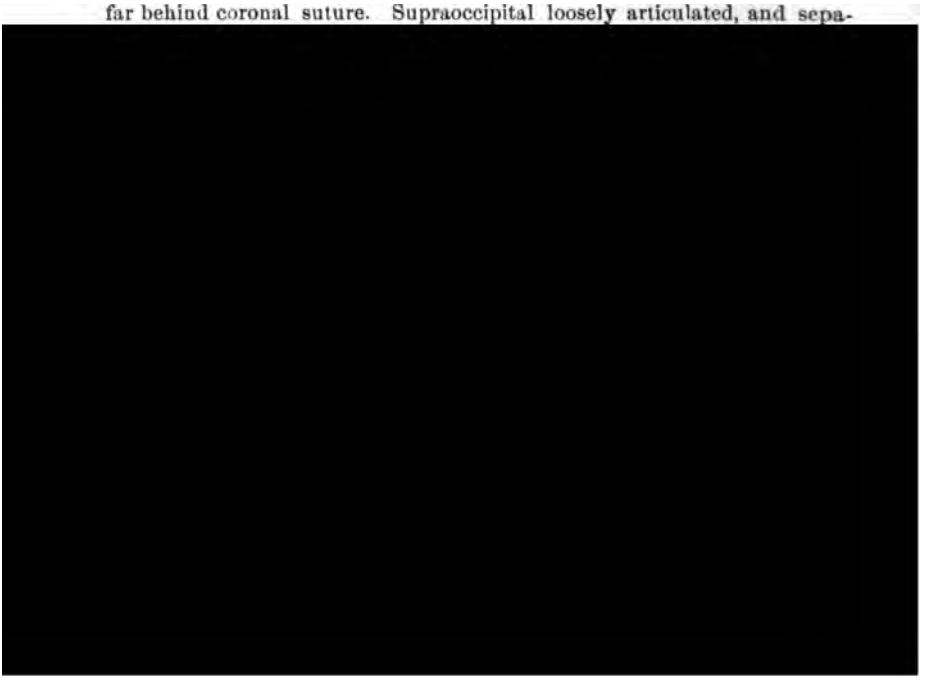
The ilium has a short *angulus cristæ*, and the acetabulum is entire. The pubis and ischium are slender and transverse in position, and approach nearly at their symphyses, which are connected by a short, narrow cartilage. The pectineal process is obsolete, while the tuber ischii is a prominent angle.

Two peculiarities especially distinguish this genus among Iguanidæ: first, the connection of the epipterygoid with the petrosal; and, second, the absence of symphysis of the chevron bones. The characters of the sternum are an extreme of what is seen in Sceloporus.

Gerrhonotus Wiegm.

A skeleton of the *G. multicarinatus* from the U. S. National Museum, furnishes the material for an osteology of this genus.

The premaxillary has a well-developed spine and a truncate palatal border. Its alveolar border is short, and it forms but a small part of the inferior nareal border. Nasal bones not short in front, rather narrowed by the maxillary and prefontals on each side. Frontal narrow, single, partly enclosing olfactory lobes of the brain below, but the incurved lateral walls not touching. Parietal with small pineal foramen far behind coronal suture. Supraoccipital loosely articulated, and sepa-



closing a very narrow down-looking groove. Basioccipital and exoccipitals coössified; condyle small, simple.

Meckel's canal closed except distally, where it is open on the *under side* of the ramus. Coronoid developed anteriorly on external face of ramus, the dentary not reaching behind its anterior border. Splenial elongate, partly external; angular mostly external; surangular confluent with articular. Angle horizontal incurved with rounded border and concave superior surface.

Hyoid apparatus displays no second and rather short first ceratobranchials. Hypohyal rather long, the ceratohyal extending a little beyond its extremity, and widened at the posterior third. A free epibranchial which has a bifurcate anterior extremity at that of the ceratohyal, and extends posteriorly but little behind the ceratobranchial.

Five cervical intercentra, and two cervicals besides atlas without ribs. The odontoid is coössified with the axis. Ribs extend to sacrum. Sacral diapophyses distinct from each other. Dorsal vertebræ without zygosphen, prezygapophyseal facets not continued on neural arch. Caudal diapophyses present; centra of middle region segmented through them; chevron bones intercentral. Neural spines low, higher on caudal region.

Suprascapula much larger than scapula; no proscapula. One large coracoid notch. Sternum without fontanelle, with three ribs and two attached to xiphoid rod.

Ilium without prominent *angulus cristæ;* acetabulum entire; pubes uniting at an acute angle; pectineal angle medium. Ischia with prominent tuber.

Cnemidophorus Wiegmann.

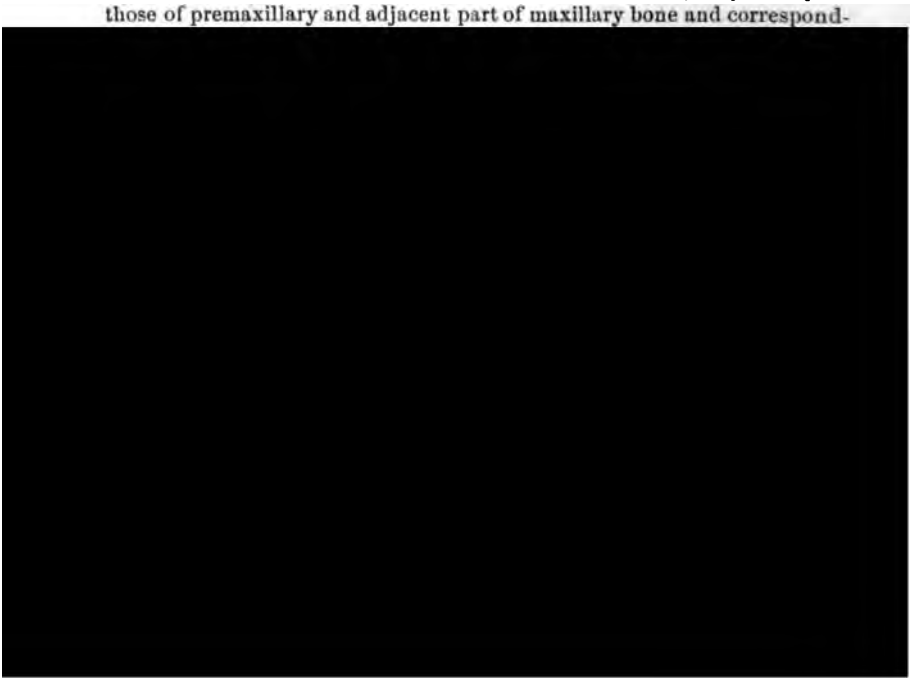
For characters of the skeleton I have three individuals of the *C. tessellatus* from my own, and one of the *C. sexlineatus* from the National collection. The alveolar portion of the premaxillary is prominent, and is marked off from that of the maxillary bone by a shallow emargination on each side. The superior spine is long, and the palatal border is deeply emarginate to receive the narrow anterior production of the vomers. The nasals are distinct and rather elongate, although encroached on in front by the enlarged nostrils. The frontal is single and is rather narrow. The parietal is without pineal foramen in the adult. The parietoquadrate arch is well elevated, and is braced below by the small paroccipital. The supraoccipital is in close contact with the parietal by its middle portion, and it is distinct from the exoccipital by suture. The prefrontal does not extend above the orbit; the lachrymal is smaller, but rather large, and forms a suture with the jugal. The postfrontal is wanting, being fused with the postorbital. The latter is produced downwards and has a longer suture with the supratemporal than with the narrow jugal. The quadrate has an external conch only. The vomers are elongate and are in contact throughout, but each is swollen on the middle line so that they are divided by a

groove along their common suture. The nareal fissure is long and narrow, and is contracted anteriorly, and then enlarged foramen-like at the anterior extremity. The vomerine branch of the palatines is longer than the maxillary branch; the pterygoid branch is not very wide, and the palatine foramen is of moderate size. The ectopterygoid is rather wide and has an anterior suture with the palatine bone as well as with the maxillary; it is deflected posteriorly. Pterygoid moderately expanded anteriorly and contracting gradually; the posterior portion but slightly grooved, and attached to the basipterygoid process by its entire width, and not by the groove only. Presphenoid rudimental; sphenoid distinguished from basioccipital by suture; the latter with descending compressed lateral processes. Petrosal with a short presemicircular process, and a long subforaminal process; the latter presenting an open groove downwards. Inferior face of frontal grooved; postoptic not reaching frontal, triradiate, the two superior limbs shorter than the inferior. Epipterygoid arising opposite ectopterygoid and in contact with a descending lateral process of the parietal and not touching petrosal.

The hyoid apparatus is distinguished, like that of other Tiidæ, by the great prolongation of the hypohyals anterior to the point of attachment of the ceratohyals. No second ceratobranchials or free epibranchials.

In the mandible the Meckelian groove is closed except at the distal portion. The coronoid is produced far anteriorly and not at all posteriorly on the external face, and the dentary does not extend much beyond the tooth line. Surangular distinct; angle horizontal, expanded, and forming an angle inwards. A distinct masseteric fossa, bounded below by the angular. Splenial elongate, extending far anterior to the splenial foramen.

Teeth with the crowns moderately compressed and unequally bicuspid; those of premaxillary and adjacent part of maxillary bone and correspond-



rected anteriorly at an acute angle, with median pectineal angle. Ischia directed vertically downwards, with *angulus tuberosus*, and pre- and post-ischiadic acuminate cartilages.

It is remarkable that in the large species of the allied genus Tupinambis the proscapular process is wanting.

Xantusiidæ.

In addition to the characters which I have previously given, Mr. Boulenger states (*Catal. Brit. Mus.*) that the sternum is without fontanelle. I find the hyoid apparatus has characters somewhat similar to those of the Lacertidæ. The ceratohyals and second ceratobranchials are both present and there is a well-developed free epibranchial. Its proximal end overlaps the distal end of the second ceratobranchial. It passes round the extremity of the first ceratobranchial and extends forwards. In Lepidophyma it has the peculiarity, which I have not seen in any other lizard, of being inserted on the lateral process of the basioccipital. In *Xantusia riversiana* (Plate vi, Fig. 41) it terminates before reaching this point. In Lepidophyma it displays a concave expansion as it passes the extremity of the first ceratobranchial, in which lies the helicoid cartilaginous extremity of the latter. In neither genus are the hypohyals prolonged with the ceratohyals, as in Anguidæ, nor beyond them as in the Tiidæ.

The stapedial disk in Lepidophyma is not sunk in a canal as in the Iguanidæ and some other Lacertilia. The columella is slender, and terminates in the interstapedial cartilage. This supports an oblique cartilaginous rod, one end of which (suprastapedial) is attached to the osseous wall above, and the other longer one (epistapedial) is in contact by a flat surface of its extremity with the membranum tympani (Plate v, Fig. 26).

The remarkable characters of the skull in Xantusia are described under the head of that genus. Bocourt (*Mission Sci. de Mexique*, Pl. xxg, Fig. 2), represents a probably similar structure in Lepidophyma.

Xantusia Baird.

My knowledge of the osteology of this genus is derived from the *X. riversiana*, specimens of which I owe to my friend, Dr. J. J. Rivers, of Oakland, Cal.

The *os premaxillare* has an elongate spine above and a nearly transverse posterior border below. Nasals well developed, distinct. Frontal single, grooved below. Parietal single, without pineal foramen, produced posteriorly so as to overhang the occipital bone and foramen magnum; being connected with the former by a median keel which it sends downwards. The supraoccipital is subhorizontal and is not articulated in the usual way with the parietal, having only the median contact above mentioned. It is coössified with the exoccipitals. The prefrontal is small and is not produced far over the orbit. Lachrymal absent. Jugal with the super-

posterior limb expanded. Postfrontal and postorbital fused into a triangular bone which bounds the parietal externally, thus, with the supratemporal, roofing over the temporal fossa. Supratemporal in contact throughout with the parietal except where separated by the narrow splint of a paroccipital. Quadrate with one, a large external conch. Vomers closely juxtaposed throughout, coössified anteriorly, the median portion of the two elements with an excavation. Nareal orifices nearly closed except posteriorly, where the vomerine process of the palatine overarches them. The latter are in contact in front but soon spread apart. Maxillary processes rather shorter than vomerine, depressed below them. Pterygoids narrow throughout, not wider than palatines, their posterior part with a groove which looks upwards and inwards. Basipterygoids overlapping their entire internal face. Ectopterygoids wide, reducing the palatine foramen to a mere slit; with a considerable contact with the palatine, and a recurved portion in contact with the extremity of the maxillary; the internal extremity depressed. No presphenoid; sphenoid separated by suture from basioccipital, whose lateral processes are compressed and decurved. The postoptic bone seems to be wanting. The petrosal is well produced beyond the semicircular canal, and is equally produced below the trigeminal foramen, where it joins a backwards directed process of the basipterygoid. The groove below it is well defined and looks downwards. The epipterygoid rises at the basipterygoid and rests on the anterior border of the petrosal and the posterior border of the well-marked descending process of the parietal. Fenestra ovale not sunk in the fundus of a fossa.

The mandible is remarkable in having but three bones. The articular, angular and surangular are coössified, and the splenial and dentary. The coronoid has little horizontal production on the outside of the ramus, and



The teeth have compressed tridentate crowns; those of the premaxillary bone are not conic, but have also compressed crowns, where traces of denticles are sometimes apparent.

The remarkable features in the osteology of this genus are (1) the peculiar relations between the parietal and supraoccipital bones, which resemble the structure seen in a sea-turtle; (2) the wide ectopterygoid; (3) the absence of lachrymal; (4) the presence of only three mandibular elements. The affinities are a mixture of those of the Lacertidæ and Scincidæ; the large postfrontal bones; the descending processes of the parietals, and the form of the pubes, resembling the corresponding parts in the latter family. The expanded cervical ribs resemble those of the Gecconid genus Phyllodactylus. The relations of the parietal and occipital bones are quite different from those found in the Lacertidæ and Anguidæ (Gerrhonotus, Celestus, Ophisaurus), where the temporal fossæ are also roofed over. In these forms the contact is normal, *i. e.*, by the elevated median portion of the anterior border of the occipital.

Eumeces Wiegmann.

For the determination of the skeletal characters of this genus I have skeletons of the *E. obsoletus* and *E. fasciatus*, from the National collection.

The premaxillary is split as in other Scincidæ, and the halves are in the closest contact. The common spine is rather elongate, while the palatal suture is simply emarginate. The nasals are not shortened, and are distinct. The frontal is double, and is simply grooved on the middle line below. The parietal is single, and is pierced by the pineal foramen at about its middle. The parietoquadrate arch is well elevated. The supraoccipital is loosely articulated, presenting a truncate median process towards, but not to, a median notch of the parietal. Exoccipital distinct by suture. Prefrontal rather large, not sending posteriorly a superciliary process, and not produced far above the orbit. Lachrymal small; not, or very little visible on external facial surface, and reached by a long internal process of the jugal. External surface of jugal separated widely from prefrontal, its postorbital portion much longer, slender, and rising to meet the postfrontal. The latter is large and unequally V-shaped, the posterior limb broad and covering the temporal fossa between the parietal and supratemporal bones, with more or less of a fissure next the parietal posteriorly. Postfrontal a splint separating the jugal and supratemporal from the postfrontal. Supratemporal well produced anteriorly, and in contact with the parietoquadrate arch for the posterior two-thirds the length of the latter. Quadrate with one, a deep external conch. The vomers are elongate, and also expanded laterally, passing above the prominent palatine laminæ of the maxillary bones. They are in close apposition on the median line, but are so swollen longitudinally as to leave a groove at the common suture. The longitudinal ribs terminate in a pair of appressed hooks which look downwards and backwards at the posterior extremities of the bones. The vomerine branch of the palatine

is not quite as long as the maxillary branch, and is on a superior plane, being in close contact with its mate on the middle line, and forming with the maxillary plate a half tube opening inwards. Pterygoids not very wide, gradually narrowing to the posterior rod which is openly grooved on the inner side. The basipterygoid processes overlap the entire width of the internal face. Ectopterygoid reaching maxillary and jugal, but not palatine; little deflected posteriorly. Presphenoid not ossified; sphenoid distinguished from basioccipital by suture. Latter with subconic descending lateral processes, which enclose a deep fossa on the external side. Postoptic small, simple, crescentic. Petrosal extended well in advance of semicircular canal above; subforaminal portion still more produced bounding a down-looking open groove. Parietal sending downwards a rather elongate process in front of petrosal. Epipterygoid originating opposite basipterygoid below, and resting above on the descending process of the parietal and the anterior margin of the petrosal. Occipital condyle tripartite.

Meckel's cartilage exposed from the anteriorly placed splenial foramen. Coronoid a little produced anteriorly on external face of ramus, not at all posteriorly. Surangular and articular distinct; angle flat, rounded, not produced or angular inwards. Dentary produced as far posteriorly as coronoid; splenial rather elongate (forming the inferior border of Meckel's groove in *E. obsoletus*).

In the hyoid system, *E. fasciatus* presents a short second ceratobranchial. The first ceratobranchial has a cartilaginous terminal segment, as has also the ceratohyal. The latter is of moderate length, is without expansions, and is articulated with the extremity of the rather short hypobranchial. There is a large free epibranchial, which commences near the free extremity of the second ceratobranchial, and curv-



Besides the family characters, this genus is well distinguished among American lizards by the divided frontal; the overroofing the temporal fossa by the postfrontal and supratemporal; the descending process of the parietal; forms of the xiphoid rods, and forms of the pelvic bones.

Anniella Gray.

My observations on this genus are based on specimens from San Diego, Cal., presented to me by my friend, James S. Lippincott.

The premaxillary has an elongate spine, and the palatal suture presents backwards two concavities separated by a median projection. The nasals are distinct and rather short and wide. The frontals are distinct and rather wide. The parietal is very large everyway, is single, and has no pineal foramen. The supraoccipital forms a close suture with it, sending forwards a median process for internal gomphosis, and an angle on each side of it. It is coössified with the exoccipital, and is expanded to accommodate the large circle of the superior semicircular canal. The facial plate of the maxillary is large. The prefrontal is above the eye, and is cut off from the postfrontal by an entrant angle only. The lachrymal is small, and is below and separated from the prefrontal. No jugal. Postfrontal crescentic, bounded by both frontal and parietal. Postorbital a caducous scale lying in contact with the posterior limb of the postfrontal. Petrosal with its superior border in close contact with the decurved lateral borders of the parietal, as in a snake. The latter do not, however, descend to the presphenoid, but leave a wide fissure below it which deeply notches the anterior border of the petrosal. Supraforaminal part of petrosal produced to an acute angle, terminating at the parietal border much in advance of the anterior semicircular canal. Body of petrosal perforated by a large foramen just in front of the superior part of the quadrate. No parietoquadrate arch, but a posteroexternal angle of the parietal extending near to the proximal extremity of the quadrate. No distinct supratemporal or paroccipital. Stapes with large disk and short stout columella, with thickened tympanic extremity. Vomers continuous anteriorly, slightly divergent posteriorly; excavated by a deep groove posteriorly, which terminates in a fossa medially. The external borders of the posterior apices are turned outwards so as to enclose partially the posterior nares below. The palatines are short, the groove separating the maxillary from the vomerine processes extending to the suture with the pterygoid, so that the maxillary process only appears as the inferior face of the bone. Pterygoids elongated anteriorly, reaching to beyond the middle of the palatine foramen. They extend directly back to the quadrates, being well separated on the middle line, and abruptly notched on the inner side to receive the short angular basipterygoids. They are separated from the sphenoid by a fissure, and are grooved on the inner side posterior to the basipterygoid. Ectopterygoids present, rather slender, enclosing rather large palatine

foramina. No epipterygoid. Nareal fissure overhung by the free edge of the maxillary and palatine bones. Sphenoid and basioccipital and exoccipital coössified. Occipital condyle convex and perfectly simple.

The mandible has an open Meckelian groove, and the surangular and articular bones are coössified, while the angular and splenial bones are distinct. The latter extends well anteriorly. The coronoid extends a little forwards on the exterior face of the ramus, and in both directions on the inner face.

The hyoid apparatus is the most simple among lizards. It consists of a continuous cartilaginous glossobasihyal rod, which is bifurcated posteriorly; and a simple osseous first branchihyal, attached to each of the branches. Other elements wanting.

Ten cervical vertebræ with compressed inferior processes of the centra or hypapophyses. They are coössified with the centra, and are not intercentral in position, hence it is not evident that they are intercentra. No zygosphen. In the *Anniella pulchra* there are seventy-three rib-bearing vertebræ, and two cervicals without ribs. The sacral and proximal caudal vertebræ have diapophyses, those of the former little different from those of the latter. The fifth vertebra with a diapophysis supports a pair of parallel plates coössified with its inferior face like the chevron or double hypapophysis of a snake. In the succeeding vertebræ similar plates form the basis of a chevron, whose symphysis is turned rather abruptly posteriorly. The position of these chevrons is central and not intercentral. Caudal vertebræ not segmented.

Scapular elements and fore limb wanting. Pelvic arch represented by a pair of slender simple bones which lie near the extremities of the last ribs, one on each side of the vent. They are slightly curved, and are well separated in front. They are very similar to the bones which occupy the

cervical vertebræ which are continuous with the centra. (5) The partially open chevron bones, which are also continuous with the centra. (6) The sublongitudinal ileopectineal bone and absence of other pelvic elements.

There is agreement in various subordinate features, as the single premaxillary, double frontal, and single parietal; and the absence of supratemporal bone; also the fusion of the surangular and articular bones. There are some differences to be noted. Thus, in some of the Amphisbænia at least, there is apparently an orbitosphenoid bone, which is wanting in Anniella. The pterygoid is more closely adherent to the basis cranii in the Amphisbænia, and there is no palatine foramen, which is present in Anniella. The splenial is of full size in Anniella and the Meckelian groove is open. In the Amphisbænia the groove is closed and the splenial is much reduced.

The presence of scales, the papillose tongue and the distinct tegumentary eye fissure, with the characters above cited, define the Anniellidæ as a very distinct family of the Amphisbænia.

Rhineura Cope.

A specimen of the *R. floridana* Baird from Volusia, Fla., furnishes the characters of the skeleton.

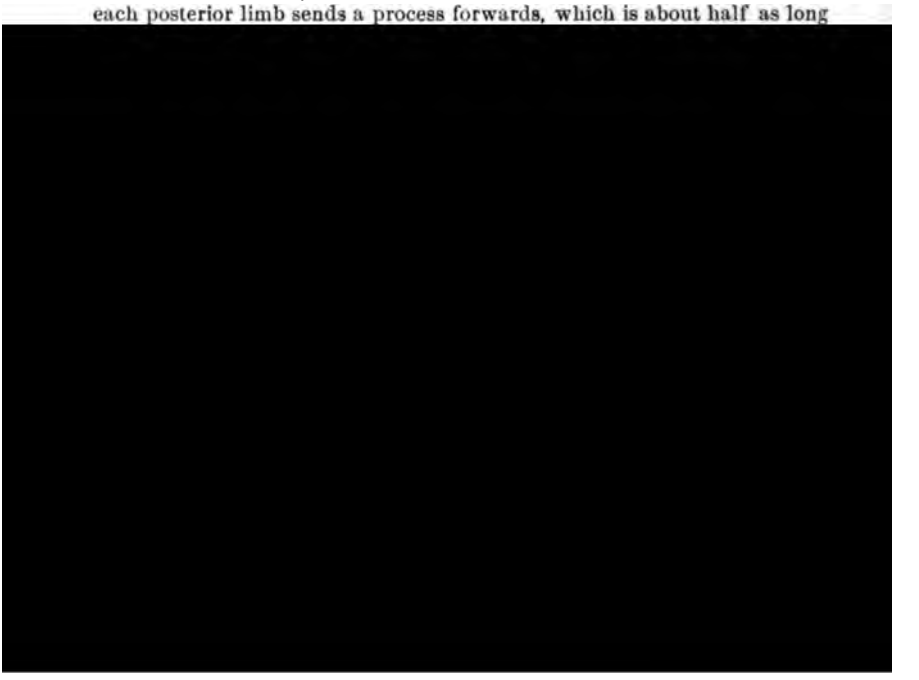
The alveolar border of the premaxillary is very short, and supports only one, a median tooth. The spine is divided into two portions, that below the projecting angle of the muzzle and that above it. The former is contracted a little by a process of the maxillary which enters from the alveolar portion, separating it from the nostril, which is inferior in position. It then expands a little, to form on the upper side of the muzzle a terminal expansion twice as wide as long. The nasals are distinct, and extend to the border of the muzzle, overroofing the nostrils. Frontals wide, distinct, deeply emarginate posteriorly for the parietal. Prefrontal rather large, triangular, sending its apex posteriorly over the orbit and reaching the parietal. Its free border and a narrow band of the parietal form a *crista temporalis*, which do not unite on the middle line into a *crista sagittalis*. Parietal single, without pineal foramen, continuous laterally with the petrosal and alisphenoid, and posteriorly with the supraoccipital, from which it receives on the middle line a gomphosis. Supraoccipital bounding foramen magnum, of which it forms a rather narrow border. A small triangular bone at the extremity of the maxillary may be a jugal or a lachrymal. The alisphenoid and petrosal form the inferior part of the side walls of the brain case, and are separated from the pterygoids and presphenoid below them by a narrow fissure which is widest below the petrosal. The latter sends an angle upwards and backwards between the parietal and exoccipital. The exoccipital sends a prolongation (paroccipital ?) downwards and forwards, which gives articulation to the quadrate, bounding the fenestra ovale above. The latter is large and is closed by the large disk of the stapes. The quadrate has no posterior

proximal process, and is oblique proximally, but is more nearly vertical distally. In its posterior angle rests the club-shaped head of the robust *columella auris*.

The vomer presents as its anterior extremity a process which separates a transverse process from each maxillary, and enters a notch in the posterior border of the premaxillary. The vomers are plane in front but become convex and separated by a fissure posteriorly, ending each in an acuminate apex lying on the presphenoid. The palatine is narrow and lies along the inner side of the ectopterygoid, consisting chiefly of its maxillary process; it is doubtful whether it possesses a vomerine process. Posteriorly it lies scale-like on the pterygoid, reaching nearly to the line of the quadrate (Pl. i, Fig. 5, B pl.). The nareal fissure is nearly closed anteriorly, except a foramen-like portion at the anterior extremity. The presphenoid, sphenoid and basioccipital are coössified. To these the pterygoid is closely appressed by the one side, while on the outer side the latter carries the narrow splint-like ectopterygoid as far as the maxillary. No palatine foramen. Occipital condyle simple, transverse, medially concave.

The mandible displays no Meckelian groove, and the splenial is small. The small angular is only visible on the internal side of the ramus. Surangular and articular confluent. Coronoid large, triangular, not concave below, and overlaid at base externally by anterior extremity of surangular; anteriorly not extended over dentary. Angle short, longer than wide, a little inflected, simple; its plane an angle of 45° to that of the ramus.

The hyoid apparatus is very simple. It consists of a glossobasihyal cartilage which is deeply bifurcate posteriorly. At the posterior extremity each posterior limb sends a process forwards, which is about half as long



Teeth simple, conic ; situated on premaxillary, maxillary and dentary bones only. Premaxillary with but one, a median tooth.

The genus Lepidosternum, as typified by the *L. octostegum*, differs from Rhineura in that the nasal bones are excluded from the nareal borders by the maxillary, and from contact with each other by the prolonged spine of the premaxillary. In both of these points Rhineura agrees with Amphisbæna. In Lepidosternum also there is a Meckelian groove, and the angle is turned vertically downwards. In *Amphisbæna* (*fuliginosa*) there is a groove and no angle.

Plate II.

Figs. 1–3. *Feylinia currorii* Gray ; × 2 ; from Gaboon, West Africa ; specimen in Museum Academy Natl. Sciences, Philadelphia.

Fig. 1. Skull, three views ; 2, skeleton of pectoral region ; 3, skeleton of sacro-pelvic region.

Fig. 4. *Anniella pulchra* Gray ; skull, × 3 ; from San Diego, California ; from specimen in my private collection presented by Mr. James S. Lippincott.

Fig 5. *Rhineura floridana* Baird ; skull, × 3 ; from Volusia, Fla. ; from specimen in my private collection from Mrs. A. D. Lungren.

The principal characters of the osteology of the Feylinia and Anniella I described in the Proceeds. Academy Philadelphia, 1864, pp. 228–230 ; and the pelvic arch of the latter and of Rhineura in a paper now in press in the *American Journal of Morphology*. Additional characters of all the above forms are described in the preceding pages.

Lettering.—Pmx., premaxillary ; *N.*, Nasal ; *F.*, frontal ; *P.*, parietal ; *So.*, supraoccipital ; *Mx.*, Maxillary ; *Pef.*, prefrontal ; *L.*, lachrymal ; *J.*, jugal ; *Pof.*, postfrontal ; *Pob.*, postorbital ; *Pofb.*, postfrontoörbital ; *St.*, supratemporal ; *Pao.*, paroccipital ; *Eo.*, exoccipital ; *Os.*, orbitosphenoid ; *Pop.*, postoptic ; *Epg.*, epipterygoid ; *Pe.*, petrosal ; *Q.*, quadrate ; *Stp.*, stapes ; *V.*, vomer ; *Pl.*, palatine ; *Pg.*, pterygoid ; *Ecp.*, ectopterygoid ; *Sp.*, sphenoid ; *Bo.*, basioccipital ; *Art.*, articular ; *Co.*, coronoid ; *Ang.*, angular ; *Spl.*, splenial ; *D.*, dentary ; *Cl.*, clavicle ; *R.*, rib ; *S.*, sacrum ; *Pv.*, pelvis.

Plate III.

Hyoid bones of Lacertilia.

Fig. 1. *Sphenodon punctatum* Gray ; nat. size ; from specimen presented by Sir James Hector.

2. *Chamæleon* sp. ; from Cuvier ; nat. size.

3. *Gecko verticillatus* Laur. ; nat. size ; from Cuvier.

4. *Aristelliger præsignis* Hallow. ; nat. size ; dissected and drawn by Dr. E E. Galt.

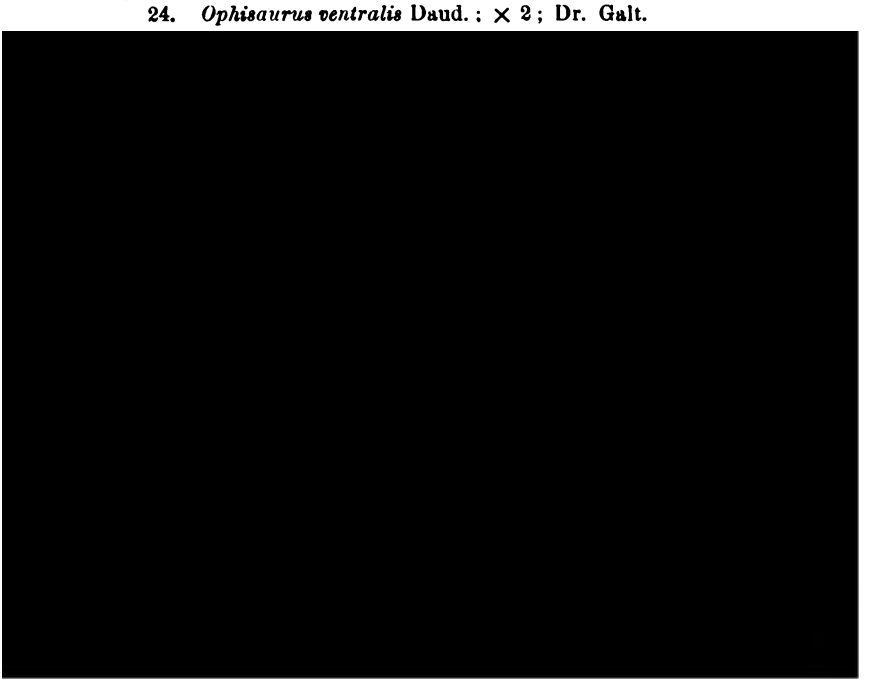
Fig. 5. *Phyllodactylus tuberculatus* Wiegm. ; × 2 ; dissected and drawn by Dr. E. E. Galt.
6. *Thecadactylus rapicaudus* Houtt. ; × 2.
7. *Eublepharis elegans* Gray ; × 2 ; Dr. Galt.
8. *Eublepharis variegatus* Baird ; × 2.
9. *Calotes cristatellus* Kuhl ; nat. size.
10. *Phrynocephalus mystaceus* Pallas ; nat. size.
11. *Uromastix hardwickii* Gray ; nat. size ; from the Zoölogical Garden of Philadelphia.
12. *Holbrookia maculata* Gir. ; × 2 ; from specimen from Otto Lerch, San Angelo, Tex.

PLATE IV.

Fig 13. *Phrynosoma coronatum* Blv. ; × 3 ; Dr. Galt.
14. *Sceloporus undulatus* Daud. ; × 2.
15. *Uta stansburiana* B. &. G. ; × ½.
16. *Sauromalus ater* Dum. ; nat. size.
17. *Crotaphytus wislicenii* B. & G. ; × 2.
18. *Anolis carolinensis* D. & B. ; × 2.
19. *Ctenosaura teres* Harl. ; nat. size (not adult).
20. *Iguana tuberculata* Laur. ; from Cuv. ; nat. size.
21. *Anguis fragilis* L. ; × 4 ; from Northern Italy.
22. *Dracæna guianensis* Daud. ; nat. size ; from specimen from Zoölogical Garden, Philadelphia.

PLATE V.

Fig. 23. *Gerrhonotus multicarinatus* Blv. ; × 2 ; Dr. Galt.
24. *Ophisaurus ventralis* Daud. ; × 2 ; Dr. Galt.



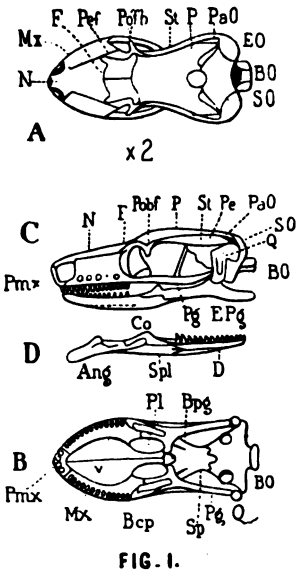


FIG. 1.

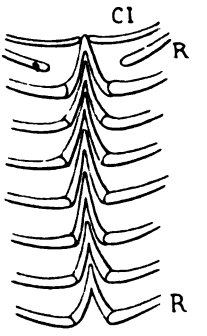


FIG. 2

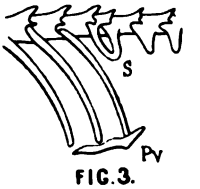


FIG. 3.

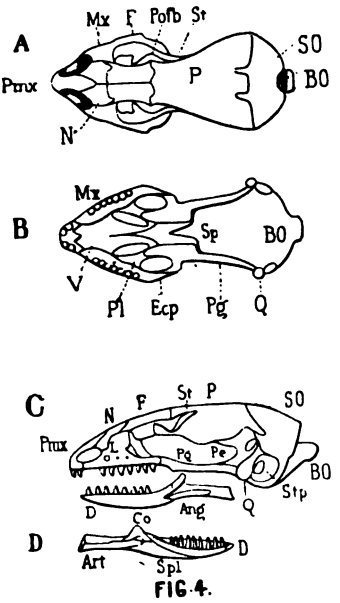


FIG. 4.

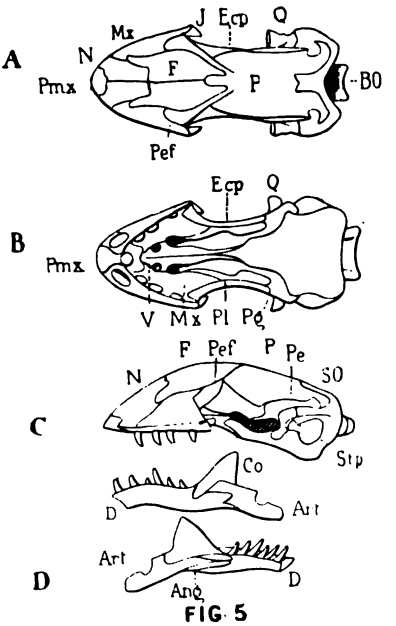


FIG. 5

1–3, *Feylinia currorii*. 4, *Anniella pulchra*. 5, *Rhineüra floridana*.



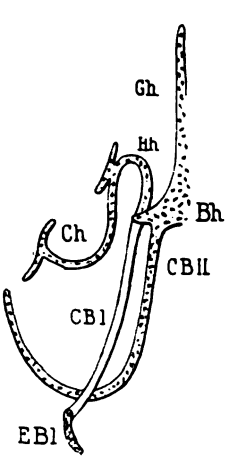


FIG. 7.

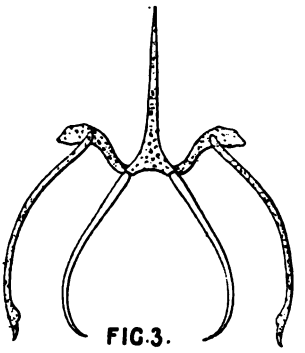


FIG. 3.

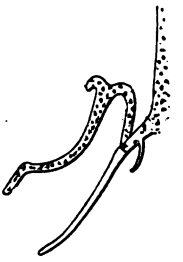


FIG. 4.

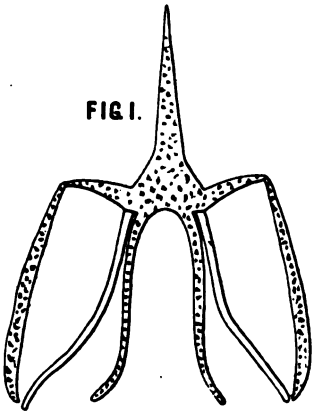


FIG. 1.

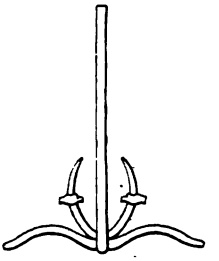


FIG. 2.

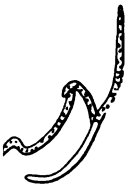


FIG. 5.

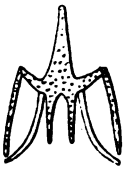


FIG. 10.

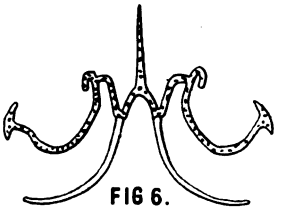


FIG 6.

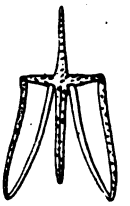
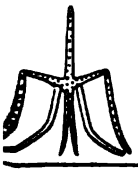


FIG. 9.

FIG. 12.



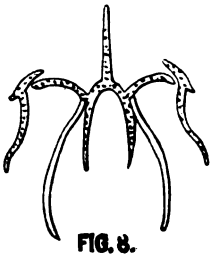
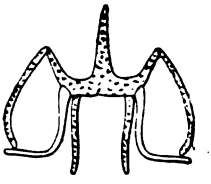


FIG. 8.

FIG. 11.



Rhiptoglossa Acrodonta Iguania.



Fig. 40. *Lacerta ocellata* Daud. ; nat. size.
41. *Tupinambis teguexin* Daud.; nat. size; from Cuvier.
42. *Cnemidophorus tessellatus* Say ; × 2.
43. *Anniella pulchra* Gray ; × 4 ; from specimen from James S. Lippincott.
44. *Chirotes canaliculatus* Bonn.; × 4.
45. *Amphisbæna alba* Linn.; ⅓ nat. size.
46. *Rhineura floridana* Baird ; × 4.

Lettering.—Gh., glossohyal ; *Bh.*, basihyal ; *Hh.*, hypohyal ; *Ch.*, ceratohyal ; *CB. I*, first ceratobranchial ; *CB. II*, second ceratobranchial ; *EB.*, epibranchial ; *St.*, stapes ; *E. St*, epistapedial ; *S. St.*, suprastapedial.

ERRATA.

Page 211, line 16, for 41 read 37.

Page 211, line 27, for Plate v, Fig. 26, read Plate vi, Fig. 38

Page 216, lines 25-30. This description of the pelvis of Anniella is erroneous. I describe it in a paper in press in the *American Journal of Morphology*, and not having the MS. with me when the present paper was written, trusted to memory, and confused it with the pelvis of Feylinia.

On Some New and Little Known Paleozoic Vertebrates.

By E. D. Cope.

(*Read before the American Philosophical Society, April 1, 1892.*)

It has been long known that the Catskill-Chemung beds of Northern Pennsylvania contain a fish bed rich in specimens. This deposit has been traced from Warren, on the west, to Susquehanna county, inclusive, on the east. It is now known that at the close of the Chemung epoch, as at the close of the Devonian in Belgium and Scotland, land emergences took place, producing more or less continued brackish and fresh-water conditions. The latter received the deposits known as the Catskill in the Eastern United States, and their alternations with Chemung beds containing Chemung invertebrate fossils are now well established as facts of our geological history. A recent visit to Tioga and Bradford counties, in Pennsylvania, has recently afforded me the opportunity of inspecting some of the localities where vertebrate fossils occur. These have been already referred to by Prof. J. S. Newberry in his work on the Paleozoic fishes of North America. Guided by two geologists residing in the regions in question—Mr. Andrew Sherwin, of Mansfield, Tioga county, and Mr. A. T. Lilley, of Leroy, Bradford county—I had an excellent opportunity of observing the mode of occurrence of the fossils and of obtaining specimens. I wish here to express my particular indebtedness to these gentlemen for the aid they have rendered me.

The locality I visited, near Mansfield, is typical Catskill. The list of species obtained is not large. They are :

Bothriolepis nitidus Leidy. *Holonema rugosum* Clayp. *Ganorhynchus*

oblongus, sp. nov. *Osteolepis* or *Megalichthys*, fragments. *Holoptychius americanus* Leidy. *Holoptychius giganteus* Agass.

From Chemung beds near Leroy I obtained :

Holonema rugosum Clayp. *Holonema horridum*, sp. nov. *Holoptychius flosus*, sp. nov.

From another locality, probably Chemung, near Leroy :

Bothriolepis minor Newb. *Coccosteus macromus*, sp. nov. *Osteolepis* or *Megalichthys*, fragments.

At the last-named locality the specimens are very abundant, but mostly dissociated, so that it is rarely that two pieces of the same fish are found in their natural relations. The bed where they occur is in some places carbonaceous from the abundant organic matter deposited there. Fragments of the Osteolepid fish above referred to are abundant, but they are too scattered for identification.

To the species found in Pennsylvania, I add the description of a fine Megalichthys from the Carbonic of Kansas.

OSTRACOPHORI.

Holonema horridum, sp. nov.

This large species is represented by the nearly perfect mold of a plate whose position may be determined by the following considerations. It has almost exactly the form of the lateral plate of the specimen of the



from end to end of the plate. The anterior part of the external border of the plate is present in the rock mold, so that a cast of its surface was not obtained; but, with this exception, the cast is nearly complete. On the middle of the plate, commencing at the anterior extremity, the ridges are least interrupted. Anteriorly they are oblique or slightly imbricate, looking outwards, and are connected at longer intervals; near the inner border, but little connected. Posteriorly they are more direct and are more frequently joined by transverse connecting ridges. Near the middle of the external region the ridges so inosculate as to produce a non-linear arrangement of round pits. On the inner side of the plate the sculpture is finer and is longitudinally honeycombed.

	MM.
Total length of plate	120
Width at middle	60
Length of anterior internal border	90
Length of posterior internal border	47

In the roughness of its surface this species exceeds those that are known to belong to the Antiarcha.

Chemung bed, Bradford county, Pa., A. T. Lilley.

Holonema rugosa Clayp.

Newberry Paleozoic Fishes of N. Amer., 1889, p. 92.

Pterichthys rugosus Claypole, Proceeds. Amer. Philosophical Soc., 1883, p. 664.

Fragments of the exoskeleton of this species are common in the Chemung beds, and they are generally of large size, much exceeding that of any other species of the Bothriolepididæ. They are generally so much broken as to render their location difficult. I obtained from Mr. Lilley a number of fragments of such a plate, which, on reconstruction, proves to belong to the posterior median dorsal plate, enough of which remains to give a good idea of its form and sculpture. The anterior margin only is entirely wanting.

The plate is obtusely rounded at the median line, giving an obtusely roof-shaped form. It is relatively rather narrow anteriorly, and widens gradually to the posterior border, where it is also flatter. The edges (lateral and posterior) are rather thin, and the lateral are obscurely beveled below, as though to overlap the lateral posterior plates. The middle line below is openly grooved on the anterior half, while a longitudinal thickening marks the middle line of the posterior fourth below. The inferior surface is smooth, while the superior surface is sculptured with the parallel grooves characteristic of the species. These grooves extend to the lateral and posterior borders. The median ones are longitudinal and without interruption throughout the length of the fragment. Those on each side of the middle line diverge slightly and reach the margin, the lateral at an acute angle as far forward as the middle of the length of the

fragment. From this point forward they diverge in a direction gradually approaching and thus reaching a right angle with the margin. The transverse grooves form a band which increases in width anteriorly until it is nearly one-third the width of the plate in front. The grooves are fine and are separated by interspaces wider than themselves. They become coarser anteriorly, the interspaces measuring 1.5 mm.; posteriorly they measure 1 mm.

The middle line above shows some unsymmetrical low tuberosities which do not correspond to cavities on the inferior side. The plate is generally thin.

Measurements.

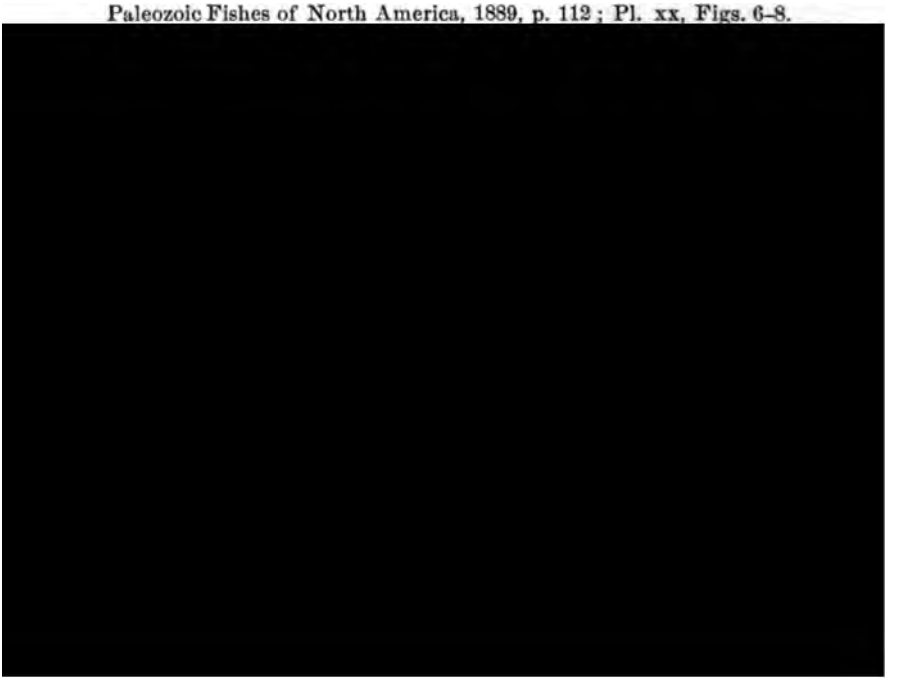
	mm.
Length of fragment	232
Width of plate at front of fragment	110
Thickness of plate at front of fragment	5
Width of plate at posterior border	120

This piece, together with the pectoral limb which I have already described, demonstrates the position of the genus to be with the Antiarcha, and not with the Arthrodira, as has been suspected by Mr. A. S. Woodward.

Chemung, Bradford county, Pa., A. T. Lilley.

BOTHRIOLEPIS MINOR Newb.

Paleozoic Fishes of North America, 1889, p. 112; Pl. xx, Figs. 6–8.



DIPNOI.

GANORHYNCHUS OBLONGUS, sp. nov.

Established on what is either the symphyseal element of a mandible, or a median bone of the superior mouth-arch. It consists of an oblong trough-shaped plate with a thickened, somewhat revolute border, which is concave in two directions; that is, in the direction of the concavity of the trough, and as a concavity of its free margin. This form indicates that it occupied an oblique position, like the elements mentioned, so that the thickened surface should fit closely the corresponding elements of the opposite jaw. There is no enamel covering the masticatory border, but this may have scaled off. There are no lateral denticles as in the Holodus of Pander. As compared with the *G. beecheri* of Newberry, this bone has the length relatively much greater as compared with the width. The width in that species exceeds the length several times, while in the *G. oblongus* the width but slightly exceeds the length. The concavity of the masticating border is greater; the size is very much less. As compared with the *G. wooduardii* Traqu., this species is very much smaller; there are no "nareal" notches; and no tubercles on the edge.

The sides of the body of the bone are nearly parallel, and the posterior border is gently convex. Two layers are visible; the interior one, like the external, has a coarsely punctate surface.

		MM.
Length	at middle	9
	at border	10.5
Width	at proximal extremity	8.5
	at masticatory extremity	13.5

From near Mansfield, Tioga county, Pa.; from the Catskill formation. From Andrew Sherwin.

TELEOSTOMATA.

COCCOSTEUS MACROMUS, sp. nov.

Fragments of this species are abundant in the Chemung rocks at Leroy, and I select as typical of it a pair of supraclavicular and adjacent pieces, which display its characters best. The supraclavicle has lost the condylar articulation. Both extremities display the unsculptured surface, and the usual groove extends obliquely across the sculptured portion at about two-fifths the length from one of the extremities. The sculpture consists of obtuse tubercles with delicate radiate-grooved bases, which are usually separated by spaces equal to their own diameters, sometimes by narrower spaces, but never by spaces which are wider. At some points they have a linear arrangement. This sculpture is coarser than in the *C. americanus* Newberry (see the Paleozoic Fishes of North America, by this author), but resembles that of the *C. decipiens* Agass. of Scotland. From this species the *C. macromus* differs in the elongate form of the supraclavicle,

which is relatively short and wide in the *C. decipiens* (see Agassiz, in the Poissons de la Vieux Gres Rouge, and Zittel, Handbuch der Paleontologie).

	mm.
Length of supraclavicle	35
Width just above condyle	16

Associated and in contact with these pieces are two acuminate oval bones which may be opercula. Each is pierced by a groove. They display the inferior side, which is smooth.

Megalichthys macropomus, sp. nov.

Established on the greater part of an individual from the Carbonic system of Kansas. With the exception of a short interval just behind the head, the specimen is complete as to its length ; the pectoral and ventral fins are damaged, and the extremity of the anal is broken off. The scales of one side of the body only are visible in the present state of the specimen, and a good many of those of the abdominal region are lost.

The general characters may be enumerated as follows : The form is slender. The scales are large and rhombic, with rounded extremities. The supratemporal (cheek) bones and opercula are very large, and are much extended posteriorly. The enamel is present on the superior aspect of the skull in small and irregular patches only, but it covers the rest of the external surfaces. It is everywhere closely and minutely impressed-punctate. The bones of the skull are thin and light.

The elements of the skull are distinguishable for the most part, the sutures being obliterated on the nasal region. The pterotics (squamosals Traquair) are longer than the postfrontals, and the parietals are longer than the frontals. The supratemporals (cheek bones Traqu.) are very

ular rami, and a median gular bone which joins the gulars with a concave suture. The gulars are large, and measure three times as long as wide at the middle. They are cut off obliquely on the inner side posteriorly, by the chevron-shaped arrangement of the pectoral scales. Several large external gulars. The posterior extremities of the mandibles are broken so that their proportions cannot be exactly ascertained, but the length preserved is six times the width opposite the anterior gular. The surface of their inferior portions is marked by coarse impressed punctures besides the usual minute ones. The former are not present on any other part of the fish.

The scales are large; between the bases of the pectoral and ventral fins can be counted about twenty-one rows, and between the ventral and the first dorsal immediately above, eight rows. The first dorsal fin is above the ventral, and the second dorsal above the anal. There are two large scales on each side which embrace the base of the first ray of the first dorsal and anal; the other fins are too imperfect at the base for description. The caudal fin is shortly heterocercal, and there are six broad fulcral scales protecting the side of its inferior border. In all the fins the rays are segmented. A half dozen rays near the border are coarse, but the remaining rays are finer. In all the fins the coarse rays are distally subdivided.

Measurements.

	MM.
Total length of specimen (20 mm. intercalated behind head)	950
Length to anterior border of orbits	45
Length to posterior border of parietals	143
Length to posterior border of operculum	230
Length to anterior base first dorsal fin	620
Width between orbits	33
Width of parietals + postfrontals anteriorly	38
Width of parietals and pterotics posteriorly	75
Length of symphyseal bone	15
Length of anterior gular	13
Length of gular	120
Length of first dorsal fin	110
Length of caudal from inferior base to superior free apex	135
Depth of body at first dorsal	85
Depth of body at second dorsal	50

This species is not nearly allied to the species from the Permian of Texas, the *M. nitidus* Cope, which is smaller and more robust in form. It has its scales and ganoine, generally, perfectly smooth, and there are but fourteen rows of scales between the pectoral and ventral fins. From the European species with punctate ganoine it differs in the longer gular bones and more elongate head, so far, at least, as concerns the *M. hibbertii* and *M. laticeps*. In *M. pygmæus* the scales are described as coarsely punctate by A. S. Woodward. Its dimensions are about equal to those

of the *M. hibbertii*. The crescentic ganoine scales of the muzzle of that species and the *M. nitidus* are absent from the *M. macropoma*.

I owe the opportunity of examining the beautiful specimen which is described above to my friend, Mr. R. D. Lacoe, of Pittston, Pa., whose collection of Paleozoic fossils is so valuable, and has been of such utility to students of the subject.

(?) Holoptychius filosus, sp. nov.

Represented by a large scale which has a peculiar and characteristic sculpture. But a small part, if any, of the proximal border is smooth. There is an area of coarse tubercles whose centre marks the proximal fourth of the long diameter, and whose vertical diameter somewhat exceeds the longitudinal. From this area there radiate in all directions to the circumference, ridges, of which the proximal are very coarse, but which become finer to the posterior side of the central area. The longer and finer ridges divide dichotomously at various points as they approach the border, the division being most conspicuous in two lines above and two below the longitudinal middle line. The ridges are quite fine and are separated by spaces rather wider than their diameter, except proximal to the area, where the reverse is the case.

This species is represented by a mold from which a cast has been made. The distal border is evidently thin, and has been more or less broken, so that its outline is not certainly known. The following longitudinal measurement may, therefore, require revision at some future time.

		mm.
Diameters of scale	longitudinal	(?)63





FIG 1.



FIG. 2

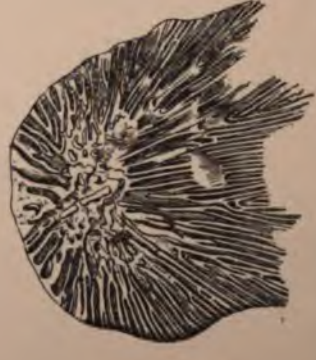


FIG 3

1. *Holonema horrida.* 2. *H. rugosa.* 3. *Holaptychius flosus.*



Megalichthys macropomus Cope.

Horizon A.
d
e
Horizon B.
c
f
S

Explanation of Plates.

Plate VII.

Fig. 1. *Holonema horrida* Cope; lateral ventral plate; two-thirds natural size.

Fig. 2. *Holonema rugosa* Claypole; lateral ventral plate; one-half natural size.

Fig. 3. *Holoptychius flosus* Cope; scale; two-thirds natural size.

Plate VIII.

Megalichthys macropomus Cope; skull from above; about three-fourths natural size; from the collection of R. D. Lacoe.

Civil and Military Photogrammetry.

By R. Meade Bache.

(*Read before the American Philosophical Society, May 6, 1892.*)

Photogrammetry is recognized as a legitimate mode of surveying. It is, in fact, if practiced with due regard to the limitations involved through spherical aberration from object-glasses of too wide aperture, a mode of surveying of considerable accuracy, although not for a moment to be compared to other perfected modes of the present day. It can never rival these in their sphere, which is the sphere of extreme precision, but at the same time it must be admitted that, within its own, it is capable of doing good service.

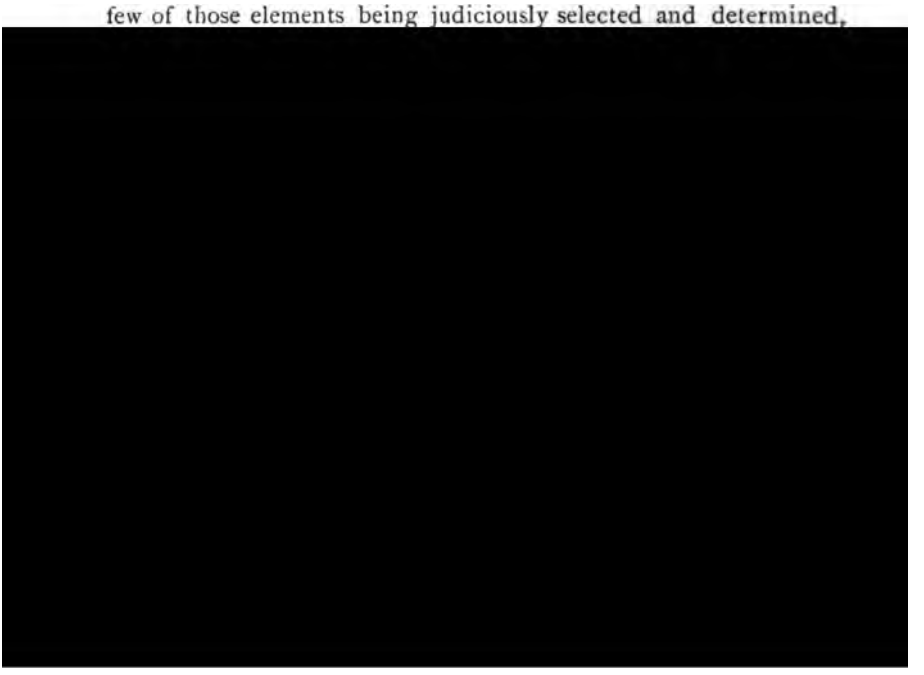
The diagram on the blackboard has been made as simple as possible, to illustrate the mode of obtaining a single vertical and a single horizontal determination. It is evident, however, that the sectors of horizon and intervening landscape belonging to each picture, assumed to have been taken from the respective stations, *A* and *B*, might be filled with objects. Many of these, from the fact of their having been visible from both stations, would be determinable by this method of cartography.

AB is a base to serve for the determination of some of the details of a survey. The optical axis of the camera being set at each station respectively upon a prominent, distant object, say a lone tree, the angle at each station between the base and that object is taken.

The rays of light eA and cB, respectively, proceed from a steeple to the photographic points of view A and B. The intersection of these rays at S gives, according to the scale of the plotted base, the horizontal position by scale of the steeple with reference to those points of view.

In deference to a misunderstanding of which I heard lately, as to the relations of the horizons to each other, as represented in this diagram, I shall endeavor to preclude it now by calling attention to the fact that the horizons are here laid down as to direction, but in order to secure the utmost simplicity in the diagram, not as to their possibility of lateral extension. Objects, for instance, in the middle distance of the steeple, as seen in elevation on horizon A, from station A, would, at station B, fall to the left of the steeple, as seen in elevation on horizon B. Conversely, objects in the general direction, and in the background of the steeple, as seen in the elevation on horizon A, from station A, would fall to the right of the steeple, as seen in elevation on horizon B, from station B.

The chief method of photogrammetry in use at the present time is illustrated by this diagram, and is based on very simple principles. The angles and distances obtained in ordinary surveying are merely natural or artificial selections. They are merely arbitrary subdivisions of space, convenient selections from an infinite number of similar elements. But it is also true that, the relations of a few of those elements being judiciously selected and determined,

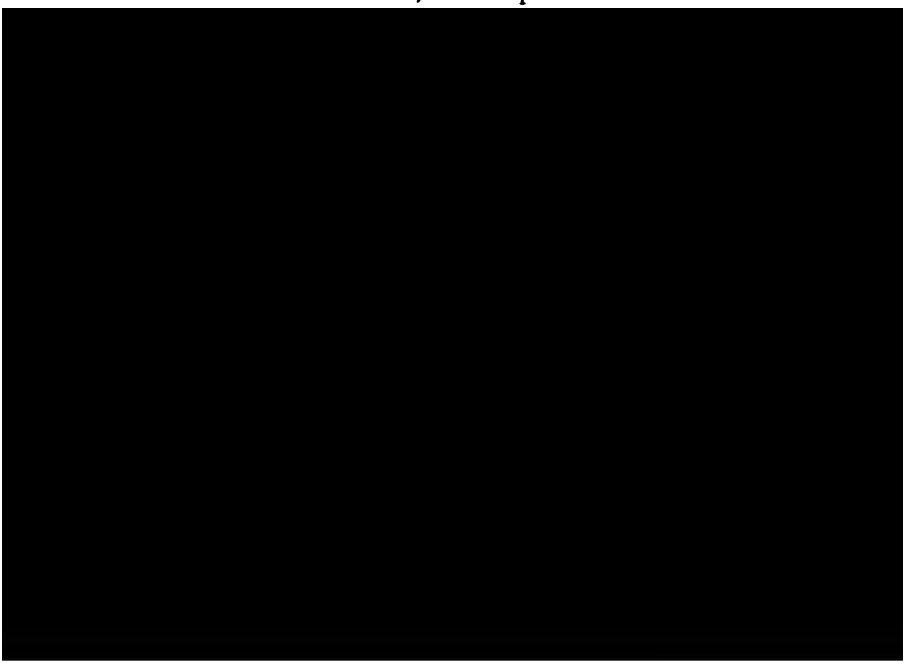


those objects relatively, as plotted, to the points of view and to one another.

Occupying with a photographic camera the points formed by the termini of a base line on the surface of the earth, having on its photographic plate imaginary vertical and horizontal lines, susceptible of being developed into real ones, the intersection of these lines corresponding with the centre of the prospective picture (the former enabling the operator to set the camera accurately to any horizontal direction, the latter giving, when the camera is leveled, the horizon for each picture), the camera is fixed in turn at the two stations upon some distant determinate object by its line of sight, its position being otherwise so adjusted that the objects to be determined in the landscape, within a given sector of the horizon, shall appear on the picture as taken from each of the two stations. The azimuth of the base line, and of the lines of sight from it, being determined by the theodolite, field transit, or compass, the survey for a particular sector of the horizon at the two stations lacks but one factor to make it complete, as soon as the pictures shall have been taken by the camera. The camera has given, by its occupation of the two stations at the ends of the base line of assumed length, only one portion of the data necessary to constituting a survey, namely, the angles subtended in nature by the various objects which come within the scope of both resulting pictures. A very simple addition, however, suffices to make the survey complete. To secure that, to introduce the element of scale, it is necessary to know the length of the base line. The scale to which the base line is plotted on paper becomes, then, through the acquisition of knowledge of the length of the base on the ground, the scale of the whole resultant map; which, it should be incidentally noted, must range by scale no further from each station than to a distance where rays of light to the two stations give good graphical intersection, the extent of the range by scale being conditioned upon the length of the rays by scale relatively to the length of the base line by scale.

Not only do rays proceeding from the same object, as introduced on two pictures properly placed, give by their intersection the horizontal position by scale of the object with reference to the base, but the angle subtended on any pictorial horizon by two objects, as seen from the properly plotted point of view of that horizon, repre-

sents on a map the actual visual angle as seen from that point of view in nature. In fact, the latter truth is that which is in nature the fundamental one in this connection. It is axiomatic that the visual angles in nature between all objects whatsoever, as projected on a given sector of the horizon, as seen by the eye of the observer, or that of the camera, from a given point of view, are the true angles between those objects, and that their sides, converged at the point of view, represent the true directions of the rays from those objects, corresponding with a base in nature with reference to which their angles are either directly or indirectly, in this case indirectly, known. Therefore it is because, in a *single* picture, the angles between different objects, in fact between all objects there, at the distance of the focal length of the camera, as seen in the picture from its plotted point of view, are the same as in nature from its point of view, that the intersection of rays from the same object, as seen on *different* pictures, placed in position corresponding with the way in which the landscape was photographed from nature, must represent by scale the horizontal position of the object as it stands in nature. That is to say, if what we see from one point of view in nature is true by angle, and also by angle true, although different, as seen from another point of view in nature, then the intersection of the individual rays, by means of which we have seen the objects in their angular positions with reference to each other, must represent their true horizontal



to execute a survey, and the area comprised by them is pictorially duplicated from one or more stations. It is always desirable that the same objects shall be seen, if good intersection of rays can be secured from the different pictures, from three stations instead of two, because an error in one of the azimuths at the end of a single base, which of course gives only two lines for an intersection of rays, would vitiate a whole survey, whereas, with two bases, involving three points of view, and the intersection of three rays, accuracy throughout a survey receives a crucial test. The adoption of this plan, which is like that employed in ordinary triangulation, is also desirable on account of its securing accuracy of plotted results; because graphical differences in the positions, as given by the intersection of only two lines, are virtually eliminated by obtaining for intersections the mean positions as derived from three lines.

The survey, so far as the instrumental part of it is concerned, being complete, it only remains that the plotting of it shall be done. The base line being laid down to scale on paper, lines are drawn from its termini, at the angles with it represented by the azimuths of the lines of sight as determined there on the ground. On this representation on paper of the lines of sight, at the respective plotted stations, are placed, at right angles, printed on thin paper, the photographs taken at the two stations, in such manner that the individual plotted line of sight shall point on the photograph upon the representation of the object upon which the real line of sight was directed in nature, after that representation shall have been vertically projected on the horizon line of the photograph, and that the horizon line of the photograph shall be distant from the individual plotted station by the focal length of the particular camera that was used in taking the pictures. The eye then, placed in position over a plotted station, and looking at a photograph corresponding to the view taken from that station, sees, as already demonstrated, that view under precisely the same angular effect as the view is presented by nature on the ground. Consequently, as angles formed by rays of light with the base line are given truly in nature, are also given truly by the camera, and are now given truly as plotted on paper to become a map, the intersection on that paper of these rays, as proceeding from the pictorial representation of the objects from which they are derived in nature, after their pictorial source has been vertically projected on the hori-

zon line of the photographs, will be the positions of the objects on the map, with due relation by scale and angles to the stations of the base line and to one another. The contemplated map will, in a word, be susceptible of being drawn throughout to scale. It is clear that a great number of objects may be thus plotted from two stations representing the ends of a base line, and that if we know the length and azimuth of a base line, and the azimuths of the lines of sight from its termini, the elements of scale and orientation will inhere in all the resulting work that goes to form a map. Used for the function described, the photographic camera is therefore very aptly called the camera-theodolite.

Adopting the same diagram to illustrate the mode of determining height by the camera-theodolite, we see the steeple, as observed upon from the point of view *A*, having the ray *eA* coming from the photographic position of the steeple as projected on the horizon line of the photograph taken from *A*. Draw from the point *e* the height of the steeple, as derived from the photograph taken from *A*, perpendicularly to the ray *eA*, and draw also the hypothenuse *Ad*. Any one intuitively perceives that the pictorial height of the steeple being *ed* at *e*, at the end of the focal length of the camera, its height at *S*, the horizontal position by scale of the steeple, must be *Sf*, and that that by scale is the true height. The length of the line *Sf* may therefore be obtained numerically by applying to it the scale of the base, which may be the scale of a



scribed, on the respective horizons as plotted on the paper to become a map.

Balloon photogrammetry has been practiced to some extent ever since the invention of the photographic dry plate. This method, however, has belonged rather to the sphere of reconnoissance than to that of surveying. When some prominent objects appear on the landscape, whose geographical relations to one another are known, the balloon photographic product may be of considerable value, if too large a circle has not been included by the camera; and this method indicated, if the desirable conditions are strictly fulfilled, may be utilized to advantage if the resulting map is not required to be of rigid accuracy. When, however, such objects are very remote from one another, even when their geographical positions are known, the spherical aberration resulting from employing a large aperture of object-glass makes a product which cannot be regarded as of high value, one which cannot properly be dignified with the name of survey in the restricted sense of the term, and to which we should prefer to apply the name of reconnoissance. Without adjusted height for the camera, without near objects of known geographical relations to one another, to obtain orientation for the results, without precise regulation of the angular aperture of the object-glass of the camera, nothing can be produced by balloon photographic process that, in the restricted sense noted, merits the name of survey.

It is on account of my perception of this low estate of balloon photogrammetry that my attention is especially drawn to devising a method of applying the art upon true principles. By my method the balloon must be captive, not free, and being captive it may be made quite small, easily managed, and inexpensive, thus rendering its employment practicable for ordinary use, especially as, according to the plan sometimes adopted in the case of the military captive balloon (to the consideration of which we shall presently come), the gas requisite for inflating the balloon can readily be carried under high pressure in metallic cylinders.

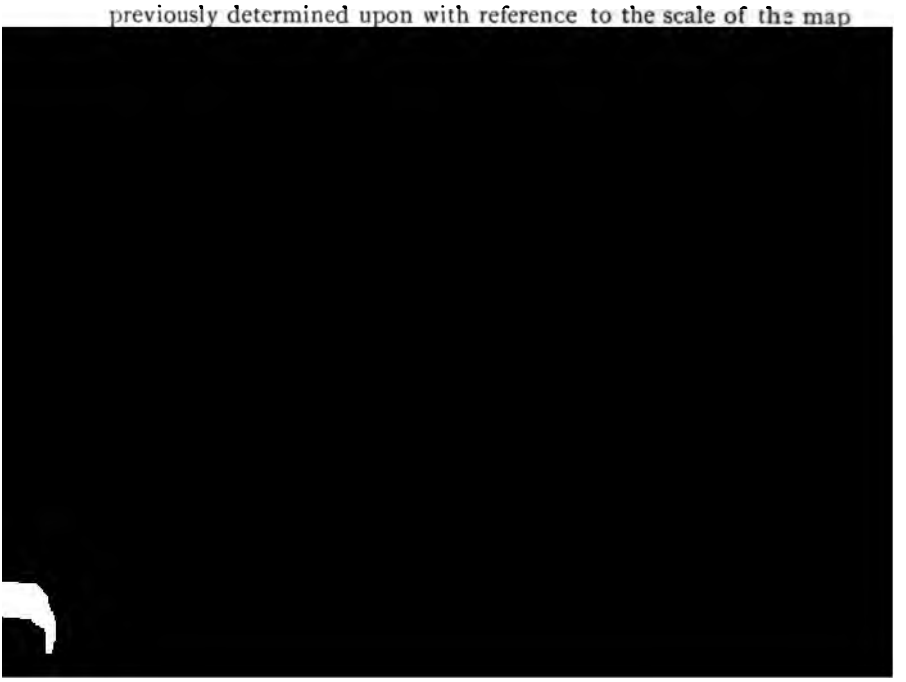
The traverse line of land surveying is merely a zigzag course, consisting of stations, the angle between each successive three of which, and distance between each successive two, is measured. From these stations details of the terrene are generally procured.

To enable a traverse line to form a portion of a general survey, there must be means adopted to place at least its initial and terminal points in relation to that survey, whereby all intermediate points fall into due relation with it.

This premised, I will now describe how my plan for introducing precision into balloon photogrammetry could be applied in various useful ways for delineations of portions of the earth's surface.

The appliances needed for carrying out the plan are a small spherical balloon capable of supporting a light photographic apparatus, swung in gimbals, and protected from injury in descent by a thin encircling cylinder of metal or of wood. A zone of cord would pass horizontally around the balloon, to which would be attached four equidistant guys of the size of codfish lines. A broad colored stripe would pass vertically around the balloon. From below the balloon would depend reophores enclosed in a graduated cord, the graduation serving the purpose of adjusting the balloon to any given height above the earth. The reophores would be electro-magnetically connected with the shutter of the camera, actuated from the ground by a small, but strong, galvanic battery.

The balloon, being inflated, would be compelled, by means of the four equatorially fastened guys, to assume a position regulated as to height by the graduated cord. This height will have been previously determined upon with reference to the scale of the map



angles and directions of the parts of the line successively submitted to its operation, as well as of delineating what it must perforce include by the photographic process in the representation of the details of the subjacent terrene. In this method the end link of a given section of the line would have to be duplicated in the advancing survey of the line, so that the relations with one another of all parts of the line should be maintained. If, additionally, the azimuth of one of the links of the line were obtained, it would communicate azimuth to all the other links. But this method can, at best, be recommended for nothing beyond the requirements of reconnoissance.

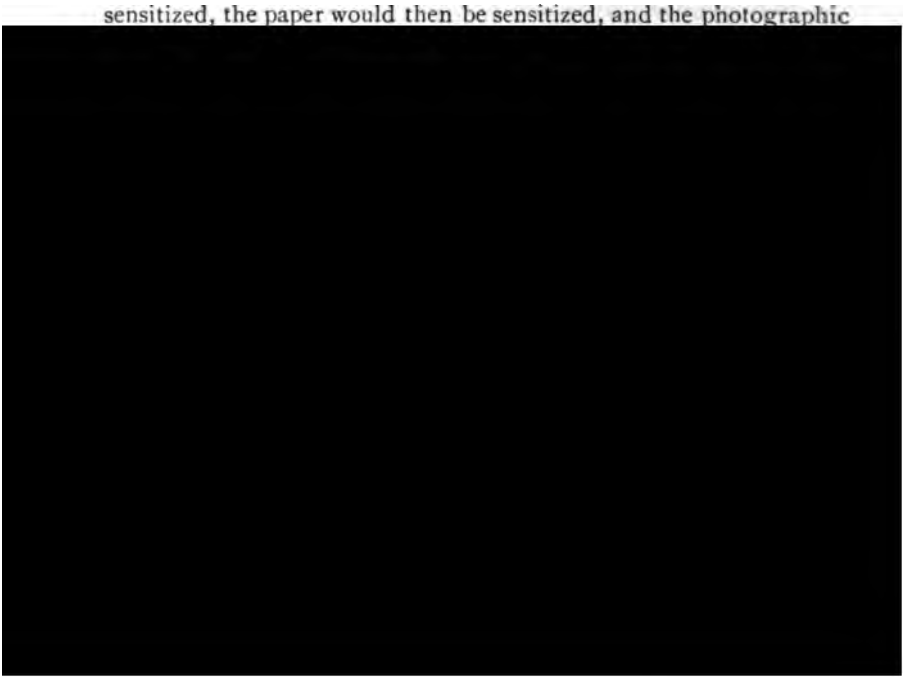
The photographing of a link of a traverse line in the precise manner first described involves, of course, the necessity that the balloon and each of the two stations representing the link over the middle of which it is floating, should be intervisible. A similar condition, as between the two stations as viewed on the ground, is indispensable. It is evident, however, that if there are trees or other obstructions on the ground, the stations might be intervisible below, and yet that each might not be intervisible with the balloon. Consequently, as not only these conditions but the condition of ample space for the management of the guys must be fulfilled, precise operations with the balloon imply the existence of open ground, or ground substantially free from obstructions to sight.

In proportion as the balloon is allowed to attain a greater and greater height, so as to include more and more of the earth's surface, the scale of the resultant map would become smaller and smaller, and the apparatus more and more unmanageable, because at a great height the guys cannot be maintained at the angles requisite to control its exact position. Therefore, it will in practice probably be found that heights of from three hundred and fifty to five hundred feet will be those most convenient for surveying by this method.

One gain made by elevation is more than counterbalanced by the loss of the clearness of delineation that belongs to a large scale. It is evident that, at moderate heights, the photographic projection of an abrupt rise of ground or other object, as, for instance, a house, on the plane of the photograph is at a greater distance by scale from the vertical passing through the balloon than it should be as related to nature, but that, as the height of the balloon above the earth increases, this error proportionately decreases. There-

fore, for the moderate elevation that must be adopted for the balloon in order to manage it, we must, with broken surface, accept greater error in delineation than would attach to the same surface if greater elevation of the balloon were permissible. But we should be reconciled to this fact from the consideration that, even were it possible to manage the balloon at the height which would virtually eliminate the error of projection mentioned, the scale of the resulting map would be so small as to approach in character the results of a reconnoissance. Another circumstance should reconcile us to the insuperable fact mentioned, and that is that there are thousands of square miles in our country where, from the very fact that the surface is essentially level, the optical difficulty attaching to moderate elevation for the balloon would not exist.

Such a survey, by balloon photogrammetry, as that described could be very easily plotted by final process of photographic printing. In consequence of the fact that the balloon would be kept at a fixed height throughout a given survey, the scale of the links of the traverse line would be established through the photographic presentment of the length of those links. The scale of those links may also be fixed by the measurement of them on the ground. So the photographic scale and the other scale may be made the same, and therefore they would be made the same. The traverse line having finally been laid down on helios paper, before the paper is sensitized, the paper would then be sensitized, and the photographic

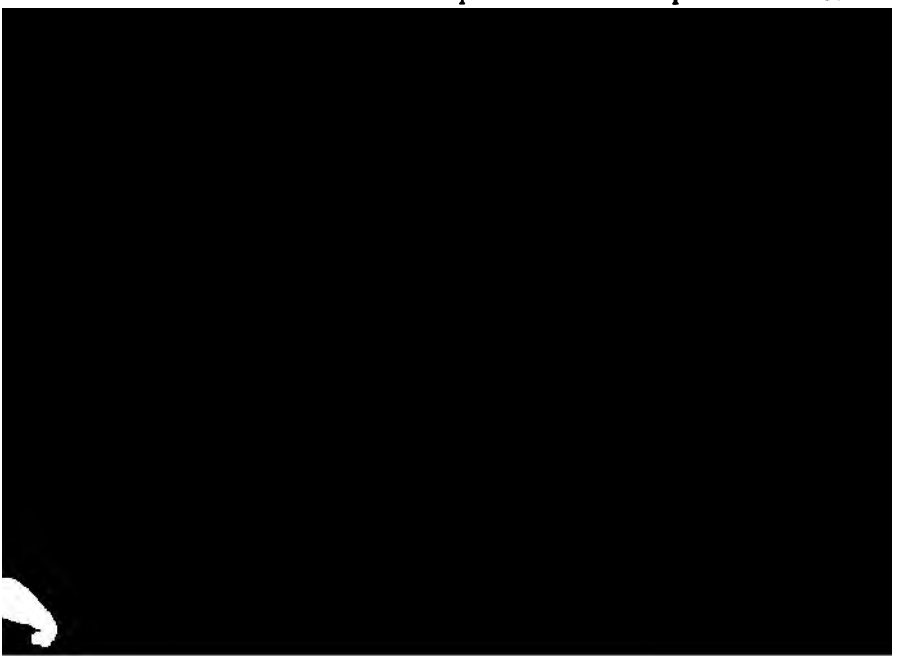


graphic apparatus, but to strain upward upon the controlling guys, because the attachment of the guys would be made to the equator of the balloon, and the weight of the dependent apparatus would be close to its periphery, and therefore to the centre of the spherical figure of the balloon. In addition, for the purpose of increasing the stability of the balloon at the critical moment of taking a photograph, the operator would steady it with a gentle draught upon the dependent cord containing the reophores, at the precise point of time when he makes the electrical contact with the shutter of the camera.

I here conclude the description of that one of my proposed additions to the art of photogrammetry which relates to precision of results obtainable from it for a continuous line of survey, and invite your attention for a moment to a method I suggest of using a similar captive balloon in a manner which would be useful in military operations. It need hardly be said that, whether captive or not, balloons have heretofore been used at great disadvantage in military operations, unless we except the use made of them for escape, with indirect reference to those operations during the recent siege of Paris. If the free aëronautic balloon passes over the enemy at such a distance as to make useful what can be observed from it, the glimpse is but transient, while its nearness and immense volume place it in great danger. If, on the other hand, a captive aëronautic balloon be used for military observation, it must ascend far from the enemy, to a height which measurably neutralizes the accuracy of the information sought.

The use for military purposes of a modification of the small spherical captive balloon which I have described would be conditioned solely upon the circumstance that the wind should be blowing towards the enemy's lines. The only change in it from the one described, that would be entailed by its new purpose, would be that it should be mounted with a simple network similar to that which is used on the kite, and to which the string for flying it, fastened similarly to the way in which it is fixed on the kite, should be attached. This string, with which the balloon would be flown like a tailless kite, would contain ordinary filigree reophores, through whose instrumentality the photographic shutter of the camera would be controlled by the operator. Lying several hundred yards away, or even a mile or two, if desirable, outside of an

enemy's lines of circumvallation, or line of battle, with the wind blowing in his direction, the balloon could be sent up with ballast proportioned to the general elevation intended for its soaring over his position. I have said "general elevation," because change of volume in the balloon, in accordance with the change of temperature, or increased weight on it, from an accession of moisture, preclude the possibility of calculating upon obtaining precise predetermined elevation for the balloon. The weight of the string for the length to be paid out to the contemplated distance would of course enter into the amount of ballast needed to secure an approximately special elevation at a special distance. The distance to the enemy's position being known, and the vertical angle being taken to the balloon from its point of departure, when it is approximately delivered at its destination, the exact remaining length of string, with allowance for sagging, necessary to pay out so as to cause the balloon fairly to dominate the enemy's military works or line of battle, would at once be known by a simple computation, or could be taken from a table of angles and distances. This operation being completely performed at several points along the opposing military lines, a series of pictures, at varying distances from front to rear, and from right to left of the enemy's position could be secured by means of the electro-magnetic attachment to the shutters of the photographic cameras, each individual one of which could take a number of pictures without replenishment of



Survey of the country for determination and description. I express here my thanks to the honorable Director of the Survey, Dr. A. R. C. Selwyn, for the opportunity of examining these important specimens.

The first specimen consists of the skull, from the orbits to the muzzle inclusive, with the two dentary bones with teeth adhering to the inferior surface. The second specimen includes most of the parts absent from the first. The muzzle and orbital region are wanting, but the parietal and occipital regions are present, with the basis cranii and palate; parts of the quadrate bones and both mandibular rami nearly complete with teeth.

The bones of the skull are dense and light, and some of them are pneumatic. The sutures separating the premaxillary, maxillary and nasal bones are not distinguishable in the specimen, and both are considerably injured. There is a large subround preorbital foramen whose centre is a little nearer the superior plane of the skull than the alveolar border. It is separated from the orbit by a narrow isthmus. The frontal bone is very narrow between the orbits. The prefrontal forms a vertical convex crest on each side, as represented by Marsh to exist in the *Megalosaurus nasicornis*. The orbits are longitudinally widely parallelogrammic, and are of enormous size, equaling in long diameter the length of the muzzle in front of them. The postfrontal and postorbital elements appear to be fused, and form an L-shaped bone, whose horizontal limb is supraorbital, extending forwards over the orbit anterior to its middle, and terminating in an acute apex. The other limb is vertical and postorbital, extending to the jugal bone. A small piece on the inner side of the postfrontoörbital at its posterior angle on the superior face of the skull is of uncertain determination. The maxillary diminishes rapidly in depth below the orbit and terminates a little posterior to it. The jugal overlaps it above, and probably terminated at about the posterior third of the orbit, but the suture is not clear at this point. The frontal is supported below by two vertical elements posterior to the middle of the orbit. These closely resemble the corresponding pieces in Sphenodon, and are the postoptic* and epipterygoid respectively. They are preceded by a vertical compressed element which corresponds with the orbitosphenoid of Sphenodon, but it is not perforate, and the optic foramen is posterior to it. It is elongate anteroposteriorly, and its anterior extremity is concealed anterior to the orbit. The postoptic is strongly concave at its anterior margin, and the inferior part of this border is produced anteriorly. The epipterygoid, on the other hand, is openly concave posteriorly, its inferior portion being directed posteriorly and enclosing a large foramen with the postoptic. The external face of the maxillary bones is rugose with fine ridges, and rather numerous foramina. The jugal extends well posteriorly, and increases in depth, but its posterior extremity is broken from the specimen.

The mandibular rami are compressed, and the symphysis is oblique and ligamentous. The dentary bone is followed posteriorly above by a deep surangular, with rounded superior border, whose superior outline, though

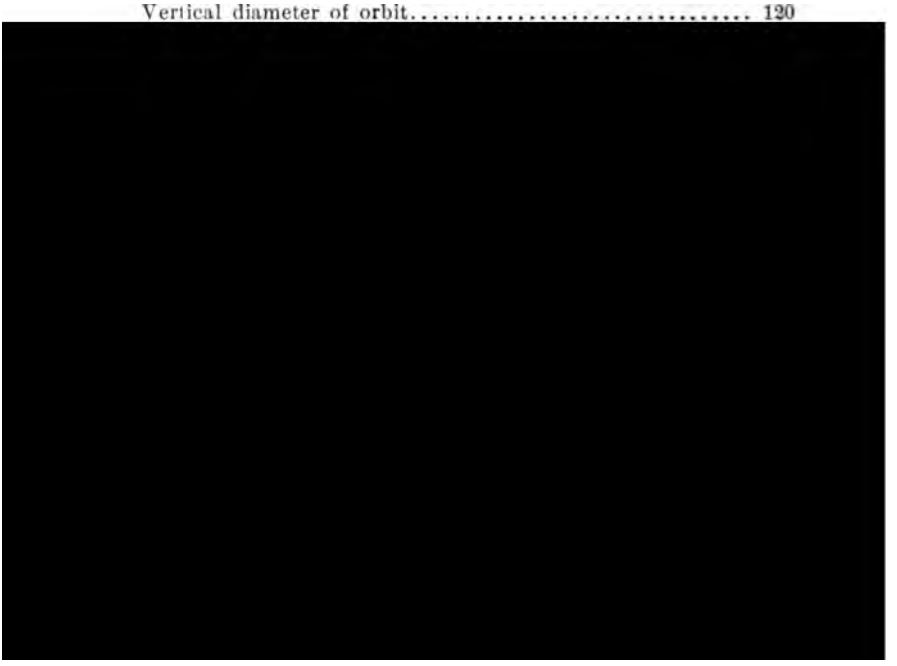
* For the definition of this element, see Proc. Amer. Philos. Soc., 1892.

convex, rises but little above the level of the dentary. The dentary is produced below it. On the inner side is seen a large splenial foramen, from which extends anteriorly a narrow strip, the splenial. The other borders of the foramen are formed by a large laminiform bone, the opercular of Cuvier, which extends to the superior border of the ramus, cutting off the dentary posteriorly. It is apparently homologous with the inferior anterior part of the coronoid. For the remaining parts of the mandibular ramus see the description of the second specimen. The external face of the dentary is roughened and presents foramina which are most numerous anteriorly, where they are connected by shallow grooves, like the rims between the holes of small Mammalia. Opposite each tooth is one or two shallow vertical grooves.

The teeth have the usual Megalosaurian form and have long roots sunk in very deep alveoli. There are eleven present in the maxillary bone, of which the terminal ones are rapidly reduced in dimensions. Fourteen teeth in the dentary bone which diminish in size at the posterior end of the series. The premaxillary teeth are lost, but none of those in the anterior part of the dentary bone have the incisor-like character of those of the genus Amblypodon of Leidy. The first tooth of the dentary is smaller than the second, and both have more convex external faces than the teeth which succeed them.

Measurements of Skull No. 1.

	MM.
Total length of specimen	600
Length (axial) to front border of preorbital foramen	140
Length to anterior border of orbit	215
Length to posterior border of orbit	385
Vertical diameter of orbit	120



foramina, one above the other, the inferior issuing in a deep groove or fossa. They are bounded externally by a broad vertical ala. Anterior to this ala are two other large foramina, one above the other, both issuing from fossæ. One or both of these is the trigeminal. The middle line of the brain case is keeled below, except near and at the anterior extremity, where it is flat and is perforated by a transverse foramen. This is possibly a pituitary foramen, which thus penetrates the palatal roof as in the Opisthocœlus Dinosauria as stated by Marsh.

The rami of the mandible are pressed obliquely against the inferior aspect of the skull, but are separated far enough to permit the palatopterygoid elements to be seen. These form a rather narrow, flattened rod on each side the middle line, which extend to the robust basipterygoid processes, which look downwards. Each pterygoid then turns abruptly outwards with its edge downwards towards the quadrate, but the specimen does not permit me to discover whether it reaches that element or not. It sends a robust process to the inner side of the basipterygoid, thus extensively embracing it. The anterior part of the palate is invisible.

The relations of the dentary and surangular bones are the same as in the specimen No. 1. This specimen shows that the angular and articular are distinct elements. The angular is an elongate element, which is extensively exposed anteriorly on the internal face of the ramus, and then passes to the external face, terminating in an acuminate lamina below the articular cotylus, but not reaching the angle. The articular is only developed anteriorly on the internal border of the ramus, where it extends well forwards, extensively overlapping the angular. The surangular extends posteriorly to the borders of the articular cotylus, and spreads out below the articular as though it would enter into the composition of the angle of the jaw, which it does not. It is perforated by a round foramen near its interior border, and its inferior face is separated from the external face by a prominent longitudinal down-looking angle. The articular cotylus is transverse and is not bifossate. The quadrate contracts immediately above its condyle and is then broken off in the specimen, but it probably has a rather slender shaft.

There is a large foramen in the internal wall of the ramus which is bounded below by the articular.

A singular bone occurs in both skulls whose position I cannot determine. It is a slender, strongly curved cylindric cone, which rises from the posterior palatal region and turns upwards, outwards and then backwards and a little downwards, with a compressed acute apex. It is not articulated with any element at the apex, which lies near the jugal bone, and its basal connections are broken away in both skulls. It is possibly a part of the hyoid apparatus, but if so it is difficult to identify it with any known element. The hypohyal is more appropriate than any other, but I do not make any identification.

Measurements of Skull No. 2.

	mm.
Length of supraoccipital on middle line	170
Length of supraoccipital including occipital condyle	230
Width of basioccipital posteriorly	155
Width of foramen magnum	35
Diameters occipital condyle vertical	40
Diameters occipital condyle transverse	70
Width of distal end of quadrate	135
Total length of mandibular ramus	950
Length of dentary above	480
Length of fourth tooth from alveolus	55
Width of fourth tooth at alveolus	27

History.—I described this gigantic reptile in the Proceedings of the Philadelphia Academy for October, 1876, from teeth derived from the Laramie formation of Montana, and afterwards (*l. c.* December, 1876, p. 340), I described it more fully from a nearly entire dentary bone with teeth from the same region. This individual did not differ much in dimensions from those now described.

Our knowledge of the structure of the cranium of the carnivorous Dinosauria has been very slowly acquired. Buckland and Mantell originally knew only the mandibular rami, but Phillips much later obtained a maxillary bone. From these fragments he proposed a restoration on the basis of the skull of the Lacertilia, with but a single postorbital bar. In this kind of restoration Prof. Owen coincided on the occasion of his description of another maxillary bone in the Quarterly Journal, Geological Soc. of London, 1883, p. 334. In a figure of a restoration, he adopted the Lacertilian model instead of the Crocodilian, and he



of the mandibular ramus omitted. In the present paper these omissions are mostly supplied, but a number of important problems remain to be definitely settled. See Trans. Amer. Philos. Soc., 1892, Vol. xvii, p. 17, where one of these is stated. I pointed out in 1866, when the genus Lælaps was described, and later, in 1869 (Vol. xiv, Trans. Amer. Philos. Soc.), that it differs from Megalosaurus in the much more acute and compressed claws. I add that the present species differs from the *M. nasecornis* of Marsh in the much larger and more anteriorly placed orbits, and in the much smaller prerobital foramen.

Figures of these remains will be given in the final publication by the Geological Survey of Canada.

Addition to the Note on the Taxonomy of the Genus Emys C. Duméril.

By G. Baur.

(*Read before the American Philosophical Society, May 6, 1892.*)

In a discussion about the type of Emys with Dr. L. Hejneyer, this gentleman called my attention to the fact that, according to the Code of Nomenclature adopted by the American Ornithologists' Union, the type species could not be *T. picta*, because this species is not named by Brogniart. According to his view not only the name *Emydes* ought to be used, as originally introduced by Brogniart in 1805 (Emys Dum., 1806), but also one of the species enumerated by Brogniart taken as the type. Brogniart mentions the following species with his genus *Emydes: E. ferox, E. rostrata, E. matamata, E. lutara, E. pensilvanica, E. clausa.* In 1806 Duméril referred the *E. matamata* to a new genus *Chelus;* in 1809 Geoffrey *E. ferox* and *E. rostrata* to *Trionyx, E. pensilvanica* belonging to *kinosternon* Spix; either *E. lutaria* or *clausa* has to be considered as type of Emydes. *E. lutaria* = *T. orbicularis* L. being the common Emysæan form, ought to be taken as type of *Emydes*, and *E. clausa* = *T. carolina* L. ought to be considered as type of *Terrapene* Merrem., of which Cistuda Fleming is a synonym.

According to this we would have the following:

Emydes Brogniart, 1805,
Type, *T. orbicularis* L.
Terrapene Merrem, 1820,
Type, *T. carolina* L.
Chrysemys Gray, 1844,
Type, *T. picta* (Herrm. MSS.) Schn

Second Contribution to the Study of Folk-Lore in Philadelphia and Vicinity.

By Henry Phillips, Jr.

(*Read before the American Philosophical Society, March 18, 1892.*)

Signs, Portents and Omens.

Sunday is always the best or the worst day of the week.

If one sews anything upon a garment that is already on, it is a sure sign that some one will tell a falsehood about you.

It is unlucky to measure a child with a yardstick before it can walk.

It is unlucky to get out of bed left foot foremost.

It is unlucky to count one's money, as it will surely decrease.

One must never count what is eaten, as hunger and poverty will be the result later in life.

A servant who comes on Saturday makes a short flitting.

If a man dies suddenly, leaving any appointments unfulfilled, his ghost will keep them.

It is lucky to dream of excrement.

Children who pick dandelions will urinate in their bed (*pis-en-lit*).

Bachelors' and old maids' children are always well brought up and well behaved.



Make a wish when a spotted horse is seen.

It is unlucky to twirl a chair upon one of its legs.

Crusts make whiskers grow.

An M marked in the palm of the hand indicates good fortune.

A woman who cuts bread into thin slices will make a poor stepmother.

Scissors and other steel articles should be hid during a thunder storm to prevent a thunderbolt.

Touching a corpse prevents bad dreams of it.

To dream of the dead is lucky.

Nose itching means sight of a stranger.

Heads of snakes never die until sundown.

Eels put on the land turn to snakes.

Never look over a person's shoulder into a mirror.

A fork dropped foretells a male visitor; a knife, a woman.

When the wind closes a shutter a stranger is announced.

If one drops a morsel in putting it to the mouth some one wants it.

If the first visitor to the house on a New Year is a man, good luck.

Go to watch meeting New Year's eve to obtain good luck throughout the year.

To rock an empty rocking chair will make angry its most constant occupant.

A Scotchman should never give a Bible.

Meeting eyebrows denote a contrary disposition; likewise hard to trust.

Very light eyes denote a shallow, variable disposition.

Blue eye beauty, do its mother's duty;
Brown eye ran away and told a lie.

To see the new moon over the right shoulder is lucky; over the left, unlucky.

Two white feet look, well about him;
Three white feet, do well without him;
Four white feet and a white nose—
Throw him to the crows.

It is unlucky, when walking with a person in the street, to permit any one to pass between and divide you.

It is unlucky to pass under a ladder.

PROC. AMER. PHILOS. SOC. XXX. 138. 2 F. PRINTED MAY 20, 1892.

If the *left* hand itches or burns it is a sign of paying out money; if the *right*, of receiving it.

Birth, Death and Marriage.

Two spoons accidentally placed in the tea saucer signifies a wedding.

Rhymes for brides-elect:

Married in white, you have chosen all right;
Married in gray, you will go far away;
Married in black, you will wish yourself back.

A white animal entering foretells death.

A child born face downwards never lives.

To drop a wedding ring from the finger indicates divorce.

If you marry in May
You will live a year and a day.

If you marry in Lent
You will live to repent.

Folk Medicine.

To cure fits in a cat one should bite off a small piece of its tail.

Warts will be produced if one handles a frog or a toad.

Warts can be removed by anointing with fasting spittle.



SEASONS, WEATHER, ETC.

Evening red and morning gray
Will send the traveler on his way.

A dried snake hung up in a draught will produce a rain.

A star near the moon means a storm.

The first three days of a month declare its character.

On the second of July the Virgin Mary goes to visit her cousin Elizabeth; the weather on that day indicates the weather for the next six weeks, that being the length of the visit.

A green Christmas means a white Easter.

The departure and return of wild geese and crows announces winter and spring.

When the white side of the leaves is exposed by the wind a storm approaches.

When the dandelions are closed there will be rain.

In the spring there comes the blossom storm.

There is always a heavy storm to fill the streams before they freeze.

On the 2d of August comes the Lammas floods.

Ember days indicate the weather of the seasons.

The rain that makes large bubbles as it falls will be of long continuance.

If it clears up at night, the next night will be rainy.

Further Notes on Fuegian Languages.

By D. G. Brinton, M.D., LL.D.

(*Read before the American Philosophical Society, May 6, 1892.*)

Since the publication of my study on the Patagonian and Fuegian dialects in the *Proceedings* of the American Philosophical Society (No. 137, 1892), several important vocabularies have come to my notice.

An Early Fuegian Vocabulary.

One of these is the oldest known collected on the shores of Tierra del Fuego itself, that of Pigafetta having been derived from the Tsoneca, on the main land of Patagonia. That to which I refer was collected by the French navigator, Jouan de la Guilbaudière, during a sojourn of eleven months in the Straits of Magellan during the year 1695. It includes about three hundred words and short phrases, and no part of it has been published. The MS. copy in my possession I owe to the courtesy of M. Gabriel Marcel, the Librarian of the Geographical Section of the National Library of France. As, however, he intends giving it publicity in the Compte-rendu of the Congress of Americanists, it will be sufficient to illustrate its character by a limited selection of words. These show that the basis of the tongue is Alikuluf, and it differs scarcely more from the Alikuluf of the present generation than do between themselves the vocabularies of that tongue by Fitzroy and Dr. Hyades in the present century. A few words belonging to the Tsoneca and the Yahgan may be detected, probably introduced by trading natives. In the vocabulary the bracketed words preceded by an A. are from the Alikuluf of Fitzroy.

Fuegian (Alikuluf) Vocabulary of 1695.



Language of the Onas (Aonas).

Up to the present time no linguistic material from Eastern Tierra del Fuego has been available; and consequently the ethnic affinities of the tribes that live there have been but guessed at.

Collectively these tribes are known to the Tehuel-het of Southern Patagonia as *Yakana-cunny*, "foot Indians," as having no horses and but few boats, their journeys are made on foot; while the Yahgans refer to their territory as *Onéçin*, the "land of men," whence the appellation "Onas."

The Onas are taller and stronger than the aquatic Yahgans and Alikulufs, who inhabit the Fuegian archipelago, and are described as in face and figure closely resembling the typical North American Indian (Popper). For this reason, apparently, it has been assumed by recent writers that they are a branch of the tall and large-limbed Patagonians north of the Straits of Magellan.

This is the opinion advanced by Drs. Hyades and Deniker in their Report in Vol. vii of the *Mission Scientifique du Cap Horn* (Paris, 1891). They acknowledge, however, that they had been unable to obtain any linguistic material on which to institute comparisons.

Such material has fortunately been secured lately by Dr. Polidoro A. Segers, and he has printed a short vocabulary in the *Boletin del Instituto Geografico Argentino* (Buenos Ayres, 1891), for which he claims exactness. It is printed apparently in the phonetics of the Spanish alphabet, which, one would think, would be far from adequate to express the sounds of the language, if we may credit the statement of the English missionary, Mr. Brydges, that they are peculiarly harsh and guttural, "resembling the sounds made by a person who is gargling with difficulty!"

The location of the Onas is described in the *Boletin* above referred to, both by Dr. Julio Popper and Dr. Segers. The tribe is divided into a number of bands, in constant feud with each other, and all without fixed habitations. To the north, between the Bay of St. Sebastian and Cape Sunday, are the Parrikens, the Shella and the Uenenke; to the south, from about Cape Penas to the Straits of Lemaire, roam the Kau-ketshe, the Koshpijom and the Loualks. These differ among themselves in dialect, but not to such an extent as to be mutually unintelligible. The precise band

from which the following vocabulary was obtained by Dr. Segers is not clearly stated, but apparently from the Parrikens.

A slight examination of this list of words is sufficient to disprove the statement made by the writers of the *Mission Scientifique du Cap Horn* that the language of the Onas is a dialect of the Southern Patagonian or Tehuelhet.

Its affinities are much closer with the Yahgan, although perhaps not near enough to allow us to speak of it as a dialect of that stock.

In the eighty-four words in Segers' vocabulary, I do not find the Yahgan correspondents for fourteen. Of the seventy remaining, twenty-three, or about one-third, are identical with the Yahgan or allied to it. Allowing for the very great difficulties in the way of a comparison of material such as I have at command, it is probable that with vocabularies carefully constructed on the same phonetic bases, and with correct identification of objects, a closer relationship between the two stocks would be demonstrated.

In the vocabulary I have placed the Yahgan equivalent in brackets, preceded by the letter Y. The Yahgan vocabularies I have employed are those of Fitzroy, Bove and the more detailed one in the *Mission Scientifique du Cap Horn*. The bracketed words preceded by Ts. are from the Tsoneca language.

Vocabulary of the Onas Language, Tierra del Fuego.

accouch, to, *tshé-ia*. drink, to, *kaieto* (Y. *kayenhama*, to



go out ! *shoim.*
hair (in general), *etshel* (Y. *atçela*, all short hair).
heart, *sá-sa* (Y. *sa-skin*).
heaven, *mata.*
hot, *pomushk.*
I, me, *iag* (Ts. *ia*).
ice, *tal.*
knife, a, *el* (Y. *ouila*).
labial commissure, *tsha-leke.*
large, *eish* (Ts. *chaish*).
lie, a, *léke.*
mamma, *iam.*
moon, *anien.*
morning, *uánko.*
mother, *tecám.*
mouth, *conken.*
nail, of finger, *kaiu* (Y. *galouf*).
neck, *kó-sel* (Y. *kaouheul*, larynx).
open, to, *diepam.*
play, to, *tal-iá.*
rain, *shen-mush.*
ready, *tshé-iéke.*
red, *poúetel.*
run, to, *ua-akka.*
sad, *eshen.*
saliva, *compé.*
sea, *paieke* (Y. *payaka*, or *hayeca*).
shut, to, *ojeme.*
sick, *póué.*
sister, *ié-eke.*
skull, *aletaia.*
sleep, to, *ashté* (Y. *ăshă*).
slowly, *la-ió.*
small, *tshool.*
smell, to, *ke-shonuan.*
smoke, *teí.*
snow, *teu.*
soon, *to-ok.*
sun, *anigke* (Ts. *gengenko*).
thanks ! *pé-ieukom-iamski.*
thick, *kátetshé.*
thou, you, *mag* (Ts. *ma*).
to-day, *má.*
urinate, to, *akketten* (Y. *ouakour*).
vagina, *pa-al.*
water, *oten.*
weak, *tshe-uel.*
winter, *sheuke.*
yawn, to, *tsha-isal.*

It will be noticed that the personal pronouns are derived from the Tsoneca, while the words for bow, bowstring and arrowhead are Yahgan. This indicates that this weapon originated with them from the latter element of their population.

The result of this comparison is to place the Onas nearer to the Yahgans than to the natives of the mainland. They are evidently a mixed people, not an independent stock, physically allied to the Patagonians, linguistically belonging in the main to the Yahgan group.

Yahgan Vocabularies.

A few words may be added on the accessible material for the study of the Yahgan language. Its grammar has been made the theme of an able analysis by Mr. Lucien Adam, and a vocabulary has been studied from the translation of the New Testament by Mr. Julius Platzmann. Both these rest on the labors of the English missionary, the Rev. Mr. Brydges. The same is apparently the

case with the quite extensive and satisfactory list of words presented in the *Mission Scientifique du Cap Horn*.

The authors of the latter point out the important fact that of the 200 Yahgan (Tekenika) words collected by Fitzroy in 1830–32, 120 are wholly erroneous, most of them belonging to the Alikuluf tongue.

In the report of Commander Giacomo Bove (*Patagonia, Terra del Fuoco, Mari Australi*, Parte i, Genova, 1883), there is a Yahgan vocabulary of 164 words. It also was obtained through the instrumentality of Mr. Brydges, and is satisfactorily accurate.

The Hongote Vocabularies.

In my previous communication on Fuegian dialects, I quoted two short vocabularies from a MS. in the British Museum said to be from the "Hongote" language, and which, from the paper forming a part of a record relating to Patagonia, I took to be dialects of that region.

This is the first opportunity I have to correct this error. Dr. Franz Boas has pointed out to me that one vocabulary is clearly Salish, and must have been collected in Fuca strait on the northwest coast. He thinks it may be the Songish dialect, a name which remotely resembles "Hongote." How it came to form a part of a mass of documents relating with this exception wholly to South America, I cannot explain. The other he considers Tlinkit.

tute, London, England (136); Pennsylvania State College Agricultural Experiment Station (136).

The following societies were placed on the Proceedings exchange list: Naturwissenschaftlicher Verein für Schleswig-Holstein, Kiel, Prussia; American Institute of Electrical Engineers, New York, N. Y.; Sociedad Cientifica Argentina, Buenos Ayres; Agricultural Experiment Stations at Blacksburg, Va., Burlington, Vt., College Station, Tex., Geneva, N. Y., Agricultural College, Mich., Baton Rouge, La., Newark, Del., and St. Anthony Park, Minn.

Accessions to the Library were reported from the Government Observatory, Madras, India; Osservatorio Marittimo, Trieste, Austria; Biblioteca N. C. V. E., Rome, Italy; Essex Institute, Salem, Mass.; Connecticut Agricultural Experiment Station, New Haven; American Museum of Natural History, New York; Agricultural Experiment Station, Newark, Del.; Dr. Charles K. Mills, Philadelphia; Department of State, Bureau of Ethnology, Superintendent of Documents, U. S. Civil Service Commission, U. S. Lighthouse Board, Washington, D. C.; Agricultural Experiment Stations at Bryan, Tex., St. Anthony Park, Minn., Topeka, Kans.; Sociedad Cientifica Argentina, Buenos Ayres, S. A.; Deutscher Wissenschaften Verein, Santiago, Chili.

Dr. Ruschenberger read an obituary notice of the late Dr. Joseph Leidy.

The decease of the following members was announced: Dr. D. Hayes Agnew, Philadelphia, March 22, 1892, æt. 74; Ario Pardee, Hazleton, March 26, 1892, æt. 82.

The President subsequently appointed Dr. William Pepper to prepare the usual obituary notice of Dr. Agnew and W. A. Ingham that of Mr. Pardee.

Prof. Cope presented a communication upon "Some Little Known Palæozoic Vertebrates."

On motion, Dr. Cope's paper on "The Osteology of the Lacertilia," offered at the last meeting for the Transactions, was authorized to be printed in the Proceedings.

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Pending nomination No. 1233 and new nomination No. 1241 were read.

The Curators reported progress in the matters committed to them by resolution of March 18.

The following resolutions offered by Mr. Bache at the last meeting then came up:

Resolved, That, if the funds of the Society permit, this room be now put in charge of a Committee, for the purpose of receiving such treatment as to its walls, ceiling and columns as accord with the character of the Society, and that the Society instruct the Curators to exclude from the cases everything but such printed matter as is desirable for ready reference, and from the floor any articles which are not conducive to the primary purpose in this room of convenience of the members of the Society.

The first resolution, referring to the decoration of the room, was withdrawn, and, owing to the lateness of the hour, the further consideration of the second resolution was postponed.

On motion of Dr. Hays, the Librarian was requested to remove from their present place of storage the books, MSS., etc., belonging to the Society.

The Committee appointed February 5, 1892, on the Columbian Celebration, was increased to five members, Dr. Ryder and Mr. Horner being added.

And the Society was adjourned by the President.

APRIL 15 falling on Good Friday, no meeting of the Society was held.

Stated Meeting, May 6, 1892.

Present, 8 members.

Mr. RICHARD VAUX in the Chair.

Letters were received as follows:

A circular inviting subscriptions for the erection of a monument to Prof. G. A. Hirn, in Colmar, Alsace.

Program of the First Anniversary of the Tacoma Academy of Sciences, April 28, 1892.

A circular letter from the Musée D'Oaxaca, Mexico, announcing the death of M. le Général Mariano Jiménez, Gouverneur constitutional de l'Etat de Michoacan d'Ocampo, February 28, 1892.

A letter from Mrs. Caroline Lewis, Secretary of the Loan Exhibition in connection with the University Lecture Association, Philadelphia, returning thanks to the Society for the loan of the busts of La Fayette and Franklin.

The following donations to the cabinet were received:

A photograph for the Society's album from Charles E. Sajous, M.D., Philadelphia.

A framed engraving of David Rittenhouse, LL.D., by E. Savage, Philadelphia, 1796, after the portrait by C. W. Peale, from Miss Emily Phillips.

Letters of envoy were received from the K. K. Astronomisch-Meteorologisches Observatorium, Triest, Austria; Bath and West and Southern Counties Society, Bath, England; Department of Science and Art, London, England; Department of the Interior, Washington, D. C.; Museo Nacional de Buenos Ayres.

Letters of acknowledgment of diploma were received from Rt. Rev. William Stubbs, Oxford, England; Prof. E. Mascart, Paris, France; Marquis Antonio De Gregorio, Palermo, Italy; Sir George G. Stokes, Cambridge, England; Mr. Charles Godfrey Leland, London, England; Mr. John Fulton, Johnstown, Pa.; Prof. Henry Willis, Philadelphia; Dr. W. J. Hoffman, Washington, D. C.

Letters of acknowledgment were received from the Royal Society of Victoria, Melbourne (136); Colonial Museum, Haarlem, Holland (136); Dr. Aristides Brezina, Vienna (136); Prof. Peter P. v. Tunner, Leoben, Austria (136); Gesellschaft für Erdkunde, Prof. F. Reuleaux, Berlin (136); Royal Saxon Society of Sciences (128, 135); Dr. Julius Platzmann, Leipzig (136); Union Geographique du Nord de la France, Donai, France (96–130 and Catalog, Parts i–iv); École Nationale

D'Agriculture, Montpellier, France (136); Editors of *Cosmos*, Profs. Abel Hovelacque, Emil Levasseur, Marquis de Nadaillac (136); Prof. E. Mascart, Paris (131–136); Philosophical Society, University Library, Cambridge, England (136); Yorkshire Geological and Polytechnic Society, Halifax, England (136); Zoölogical Society (Trans. xvi, 3 and 130–136), Royal Society, R. Astronomical Society, Linnean Society, Royal Institution, Geological Society, R. Meteorological Society, Prof. William Crookes, Dr. William H. Flower, Sir Rawson W. Rawson, London, England (136); Mr. Samuel Timmins, Arley, Coventry, England (136); Natural History Society of Northumberland, etc., Newcastle-on-Tyne (136); Geographical Society, Manchester, England (96–130 and Catalog); Royal Society, Royal Observatory, Edinburgh (136); Mr. Hamilton A. Hill, Boston, Mass. (134); Harvard College, Cambridge, Mass. (Catalog, Part iv); Mrs. Helen Abbott Michael, Philadelphia (135, 136); Agricultural Experiment Station, Newark, Del. (135, 136); U. S. Naval Institute, Annapolis, Md. (136); U. S. Geological Survey, Washington, D. C. (136); Rev. Henry S. Osborne, Oxford, O. (136); State Agricultural College, Manhattan, Kans. (136); State University, Iowa City, Ia. (134, 136); California Academy of Sciences, San Francisco (136); Texas Agricultural Experiment Station, College Station (135, 136 and pams.); Musée de La Plata, Argentine Republic, S. A. (135); Mr. Everard F. im Thurn, Georgetown, British Guiana, S. A. (136).

Letters of acknowledgment (137) were received from the Geological Survey, Ottawa, Canada; Hon. J. M. Le Moine, Quebec; Sir Daniel Wilson, Canadian Institute, Toronto; Bowdoin College, Brunswick, Me.; Historical Society, Society of Natural History, Portland, Me.; Prof. C. H. Hitchcock, Hanover, N. H.; Vermont Historical Society, Montpelier; Amherst College Library, Amherst, Mass.; Museum of Comparative Zoölogy, Prof. Alexander Agassiz, Mr. Robert N. Toppan, Cambridge, Mass.; Institute of Technology, Boston Society of Natural History, Mass. Historical Society, Athenæum, Messrs. Thomas M. Drown, Hamilton Hill, Robert C.

Winthrop, Boston; Mr. James B. Francis, Lowell, Mass.; Free Public Library, New Bedford, Mass.; Dr. Pliny Earle, Northampton, Mass.; Essex Institute, Salem; Prof. Elihu Thomson, Swampscott, Mass.; American Antiquarian Society, Worcester, Mass.; Prof. George F. Dunning, Farmington, Conn.; Conn. Historical Society, Hartford; N. H. Colony Historical Society; Prof. James Hall, Albany; Prof. W. Le Conte Stevens, Brooklyn; Buffalo Library; Prof. Edward North, Clinton, N. Y.; Profs. T. F. Crane, J. M. Hart, B. G. Wilder, Ithaca, N. Y.; University of the City of New York, Historical Society, Amer. Institute of Electrical Engineers, N. Y. Hospital, Amer. Museum of Natural History, Profs. J. A. Allen, Daniel Draper, R. W. Raymond, J. J. Stevenson, W. P. Trowbridge, New York; Vassar Brothers' Institute, Poughkeepsie; Oneida Historical Society, Utica; Prof. Henry M. Baird, Yonkers; U. S. Military Academy, West Point; Dr. Charles R. Dudley, Altoona, Pa.; Dr. Robert H. Alison, Ardmore; Prof. Robert W. Rogers, Carlisle; Hon. Eckley B. Coxe, Drifton; Profs. J. W. Moore, Thomas C. Porter, Traill Green, Easton; Mr. Andrew S. McCreath, Harrisburg; Mr. John Fulton, Johnstown; Linnean Society, Lancaster; College of Physicians, Engineers' Club, Library Company of Philadelphia, Numismatic and Antiquarian Society, Academy of Natural Sciences, Wagner Free Institute, Messrs. Cadwalader Biddle, Arthur E. Brown, S. Castner, Jr., Robert Patterson Field, William W. Jefferis, G. deB. Keim, Benjamin Smith Lyman, James T. Mitchell, Robert Patterson, Franklin Platt, Theodore D. Rand, J. G. Rosengarten, Coleman Sellers, William P. Tatham, D. K. Tuttle, Louis Vossion, Ellis Yarnall, Profs. John Ashhurst, Jr., E. D. Cope, F. A. Genth, Jr., H. D. Gregory, Benjamin Sharp, Albert H. Smyth, H. W. Spangler, Admiral Macauley, Drs. D. G. Brinton, John H. Brinton, George Friebis, Charles A. Oliver, C. N. Pierce, W. S. W. Ruschenberger, William H. Wahl, Philadelphia; Prof. John F. Carll, Pleasantville; Rev. G. W. Anderson, Rosemont; Dr. John Curwen, Warren, Pa.; Philosophical Society, Messrs. Philip P. Sharples, Washington Townsend, West Chester;

Agricultural Experiment Station, Newark, Del.; Mr. William M. Canby, Wilmington, Del.; Mr. Isaac C. Martindale, Camden; Free Public Library, Jersey City; Profs. Charles W. Shields, C. A. Young, Princeton; Va. Historical Society, Richmond; Mr. Jed. Hotchkiss, Staunton, Va.; University of Virginia, Leander McCormick Observatory, Dr. J. W. Mallet, University of Virginia; West Va. University, Prof. J. C. White, Morgantown, W. Va.; Prof. Lyon G. Tyler, Williamsburg, Va.; U. S. Naval Institute, Annapolis, Md.; Maryland Institute, Peabody Institute, Baltimore; Agricultural Experiment Station, College Park, Md.; Agricultural Experiment Station, Raleigh, N. C.; Georgia Historical Society, Savannah; University of Alabama, Tuscaloosa; Prof. E. W. Claypole, Akron, O.; University of Cincinnati, Cincinnati Observatory; Journal of Comparative Neurology, Granville, O.; Rev. Henry S. Osborn, Oxford, O.; Dr. Robert Peter, Lexington, Ky.; Athenæum, Columbia, Tenn.; Prof. J. L. Campbell, Crawfordsville, Ind.; Purdue Experiment Station, LaFayette, Ind.; Col. William Ludlow, Detroit, Mich.; Academy of Natural Sciences, Davenport, Ia.; Iowa State University, Iowa City; Agricultural Experiment Station, State Historical Society of Wisconsin, Madison, Wis.; University



guedocienne de Geographie, Montpellier, France; M. Désiré Pector, Paris; Bath and West of England Society, and Southern Counties Association, Bath; Yorkshire Geological and Polytechnic Society, Halifax, England; Royal Meteorological Society, British Association for Advancement of Science, Solar Physics Committee, London; Natural History and Philosophical Society, Belfast; Philosophical Society, Glasgow; Mr. Horatio Hale, Clinton, Ontario, Canada; Marine Biological Laboratory, Boston; Public Library, Salem; American Antiquarian Society, Worcester; Yale University, New Haven; Historical Society, Buffalo; Columbia College, Historical Society, Prof. J. A. Allen, Hon. Seth Low, New York; Penna. State College, Harrisburg; University of Pennsylvania, Mercantile Library, Prof. Albert H. Smyth, Drs. D. G. Brinton, Charles K. Mills, C. A. Oliver, W. T. Parker, Messrs. W. S. Baker, Henry Phillips, Jr., Philadelphia; U. S. Naval Institute, Annapolis; Johns Hopkins University, Baltimore; Department of the Interior, U. S. Coast and Geodetic Survey, Bureau of Ethnology, Dr. A. C. Peale, Washington, D. C.; Elisha Mitchell Scientific Society, Raleigh, N. C.; General Society of the Sons of Revolution, Savannah, Ga.; Society of Natural History, Cincinnati; Academy of Science, St. Louis, Mo.; University of California, Berkeley; Academy of Sciences, Mercantile Library Association, San Francisco; State Board of Agriculture, Lansing, Mich.; State Historical Society, Fremont, Neb; University of Nebraska; Observatorio Meteorologico-Magnetico Central, Mexico; Museo Nacional, Buenos Aires, S. A.; Agricultural Experiment Stations: Hanover, N. H., Amherst, Mass., Uniontown, Ala., Lexington, Ky., Knoxville, Tenn., Agricultural College, Mich., Madison, Wis., Topeka, Kans., Las Cruces, N. M., Brookings, S. Dak., Tucson, Ariz.

Mr. Bache read a paper on "Civil and Military Photogrammetry."

A paper by Prof. Daniel G. Brinton, entitled "Further Notes on Fuegian Languages," was presented.

Prof. Cope presented a paper "On the Skull of the Dinosaurian Lælaps Incrassatus."

A paper by Prof. G. Baur (Worcester, Mass.), entitled "Additional Note on the Taxonomy of the Genus Emys," was presented.

Pending nominations Nos. 1233 and 1241 were read.

The following report of the Curators was presented and its consideration was postponed.

In response to the resolution of the Society, in which the Curators are instructed to state the nature of the Society's collections at present housed outside of this Hall, together with the space they would occupy if properly displayed, we have to report as follows:

1. Coins at Memorial Hall, deposited about 1878. The collection is small, probably not five hundred pieces. These could be easily displayed in a case such as that now at the southwest corner of this meeting room. There is, however, a fine oak cabinet belonging to the Society, at present in charge of the Numismatic Society, which is of ample capacity, and could be utilized if necessary.

2. The Poinsett and Keating collections of Mexican and other objects. These comprise about twenty-eight hundred objects of archæological interest. The combined collection is perhaps unique in some respects, and was deposited at the Academy of Natural Sciences in 1878. We believe



Stated Meeting, May 20, 1892.

Present, 24 members.

President, Mr. FRALEY, in the Chair.

Correspondence was submitted as follows:

A letter from the Committee of Philadelphia Councils on the Columbian Celebration at Chicago, in 1893, requesting the loan of certain articles owned by the Society was read and the consideration of the subject was postponed.

Letters of envoy were received from the Geological Survey of India, Calcutta; K. P. Meteorologische Institut, Berlin; K. Leopoldinisch-Carolinische Akademie, Halle a. S.; K. Sächsische Gesellschaft der Wissenschaften, Leipzig; Société de Physique et d'Histoire Naturelle, Geneva, Switzerland; Royal Statistical Society, Zoölogical Society, London, Eng.; Geographical Society, Manchester, Eng.; U. S. Coast and Geodetic Survey Office, Washington, D. C.

Letters of acknowledgment were received from Captain Richard C. Temple, Mandalay, Birmah (135); Comité Geologique de la Russie, St. Petersburg (136); Société Hongroise de Géographie, Budapest (96–130, and Catalog, Parts i-iv); Prof. A. E. Nordenskiöld, Stockholm, Sweden (136); Prof. Senat G. Capellini, Bologna, Italy (132, 133, 134, 135); Naturforschende Gesellschaft des Osterlandes, Altenburg, Germany (136); K. Geodätisches Institut, Berlin (96–130, 136, and Catalog, Parts i-iv); Redaction der Naturwissenschaftlichen Wochenschrift, Berlin (136); Naturwissenschaftlicher Verein, Bremen (136); Verein für Erdkunde, Dresden (136); Wetterauische Gesellschaft für die Gesammte Naturkunde, Hanau (135); Bibliothek der Astronomischen Gesellschaft, K. Sternwarte, Prof. J. Victor Carus (135), Dr. Caspar René Gregory (136), Leipzig; Académie Royale des Sciences,

Lisbon, Portugal (131–134); Entomological Society, London (136); Prof. James Geikie, Edinburgh (136); Natural History Society, Sir J. W. Dawson, Montreal (137); U. S. Institute of Science, Halifax, N. S. (137); State Library of Massachusetts, Boston (137); R. I. Historical Society, Providence; Franklin Society, Providence, R. I. (137); Yale University, New Haven (137); Academy of Sciences (137); Editor of the *Popular Science Monthly*, New York (119, 131, 133); N. J. Historical Society, Newark (137); Prof. L. B. Hall, Haverford, Pa. (137); Mrs. Helen Abbott Michael, Messrs. Thomas M. Cleeman, Louis A. Scott, Philadelphia (137); Patent Office, Anthropological Society, U. S. Coast and Geodetic Survey, Departments of the Interior and Agriculture, Naval Observatory, U. S. Geological Survey, Mr. William B. Taylor, Profs. S. F. Emmons, Herman Haupt, C. V. Riley, Charles A. Schott, Rt. Rev. John J. Keane, Dr. W. J. Hoffman, Washington, D. C. (137); Agricultural Experiment Station, Baton Rouge, La. (137); Lick Observatory, Mount Hamilton, Cal. (137); Prof. Daniel Kirkwood, Riverside, Cal. (137); Prof. George Davidson, San Francisco, Cal. (137); Sociedad Cientifica "Antonio Alzate," Mexico (137); Museo Michoacano, Morelia, Mexico (137); Colorado Scientific Society, Denver



Allen, Mr. Edward L. Youmans, New York, N. Y.; Mr. William J. Potts, Camden, N. J.; Messrs. William S. Baker, Henry Phillips, Jr., Philadelphia; Interstate Commerce Commission, Washington, D. C.; Academy of Science, Mercantile Library Association, St. Louis; Colorado Scientific Society, Denver.

The following deaths were reported:

Dr. C. A. Dohrn (Stettin), May 5, 1892, æt. 87.
August William Hoffman (Berlin), May 6, 1892, æt. —

The minutes of the Board of Officers and Council were submitted and the following preambles and resolutions therefrom were read and considered.

Mr. Phillips moved:

"*Whereas*, This Society did in the year 1843 celebrate the Centennial Anniversary of its foundation by a series of addresses, meetings, receptions, exercises, etc., upon the 25th, 26th, 27th, 28th, 29th, and 30th days of May, the results of which were published in a special volume of over two hundred pages; and,

"*Whereas*, We are approaching the Sesqui-Centennial Anniversary of the same auspicious event; therefore, be it

"*Resolved*, That the Society will celebrate the same in a worthy and becoming manner.

"*Resolved*, That the President be authorized to appoint a Committee of five members to make all necessary arrangements for the same and with full power to act, and that the President be *ex officio* a member of said Committee."

The preamble and resolutions being considered by the Society were unanimously agreed to.

The President subsequently appointed as said Committee Messrs. Henry Phillips, Jr., Chairman, J. Sergeant Price, Daniel G. Brinton, Richard Vaux and William V. Keating.

Pending nominations Nos. 1233 and 1241 were read, spoken to and balloted for.

New nomination No. 1242 was read.

The following report and resolutions were presented by Mr. Williams:

Your Committee, appointed under a resolution passed as follows:

"*Resolved*, That a Committee of three be appointed by the President to consider and report to the Society upon the advisability of an annual grant for the purpose of aiding the publication or assuming the entire cost of publishing transcripts of the Babylonian tablets on deposit in the Museum of the University of Pennsylvania"

has the honor to report that the collection of clay tablets inscribed in cuneiform from the Temple of Bel at Niffer, now deposited in the Museum of the University of Pennsylvania, numbers nearly seven thousand specimens and constitutes the most important collection of this character in the country, and one of the most important in the world, ranking third among such collections. The consecutive character of these temple archives, the long period they cover, and their complete and varied character, render their publication of the utmost importance to the world of learning, while the circumstance that similar records are frequently repeated render it possible to give a fair summary by publishing portions arranged in selected series, by dynasties and with reference to the subjects treated. It is therefore practicable to publish successive volumes of these texts, each of which shall be complete in itself, and which do not necessarily involve the publication of others in the series, though the value of all will be greatly increased by the publication of the whole.

The first cuneiform text was published by the East India Company in 1804, the inscription in its collection being engraved. Publications of



The publication of the first volume presents therefore a single issue on a subject of the utmost importance to sound scholarship, a credit to American learning, and a work which will not see the light by private enterprise. Your Committee feels that this is a case which appeals directly to this Society, coincides with its past policy, and is certain to add to the value and importance of its Transactions. On inquiry it appears that a sum nearly sufficient for this expenditure can be secured out of this year's appropriations, and the remainder can be provided for out of next year's income. The Transactions offer a medium in all respects suitable, its page being of the proper size and the method of publication enabling the volume to be issued separately and should the series be continued, they can be numbered consecutively. Your Committee therefore recommend the passage of the following resolutions.

"*Resolved*, That it is the sense of the Society that the publication of the cuneiform texts transcribed from the tablets in the Museum of the University of Pennsylvania be begun by the publication of a single volume, without committing the Society to the publication of successive volumes in the series.

"*Resolved*, That this volume be submitted for approval to the Publication Committee of the Society and be issued by the Committee as a part of the Transactions, due reference being had to future publications in the series, if the same shall be determined upon in due course under the rules and order of the Society."

TALCOTT WILLIAMS,
J. SERGEANT PRICE,
PATTERSON DU BOIS,
Committee.

After a discussion the resolutions were adopted, and also a third resolution offered as an amendment by Mr. Martindale:

Resolved, That the sum of $500 in addition to the amount already appropriated for the publications of the Society be granted in order to further the publication of the texts referred to in the foregoing report.

The deferred business of the Society was taken up and considered, and the following resolution offered by Mr. Bache, was considered:

Resolved, That the Society instruct the Curators to exclude from the cases in the meeting room of the Society everything but such printed matter as is desirable for ready reference, and from the floor any articles which are not conducive to the primary purpose in this room of convenience of the members of the Society.

After discussion, the motion was voted upon and lost.

The report of the Curators presented at the last meeting of the Society was read.

The following motion of Dr. Morris, offered March 18th, was then taken up and considered.

"*Resolved*, That the Secretaries be requested to ask from the Academy of Natural Sciences, the Numismatic and Antiquarian Society and the Historical Society, the return of all the articles belonging to this Society that are now deposited with them."

And after discussion the portion relating to the deposit of the coins of the Society with the Numismatic and Antiquarian Society was withdrawn.

The following resolution was then offered as an amendment by Mr. Williams:

Resolved, That the resolution be referred to the Curators with instructions to report a plan for cataloging and labeling the Poinsett and Keating Collection, and of placing it where it will best serve the purposes of ethnological study.

The amendment was agreed to by a vote of 13 to 7.

The following gentlemen were declared duly elected mem-

him the communication, description, or model, except the officer to whom it shall be entrusted; nor shall such officer part with the same out of his custody, without a special order of the Society for that purpose.

6. The Society, having previously referred the several communications from candidates for the premium, then depending, to the consideration of the twelve counsellors and other officers of the Society, and having received their report thereon, shall, at one of their stated meetings in the month of December, annually, after the expiration of this current year (of the time and place, together with the particular occasion of which meeting due notice shall be previously given, by public advertisement) proceed to final adjudication of the said premium; and, after due consideration had, a vote shall first be taken on this question, viz.: Whether any of the communications then under inspection be worthy of the proposed premium? If this question be determined in the negative, the whole business shall be deferred till another year; but if in the affirmative, the Society shall proceed to determine by ballot, given by the members at large, the discovery, invention or improvement most useful and worthy; and that discovery, invention, or improvement which shall be found to have a majority of concurring votes in its favor shall be successful; and then, and not till then, the sealed letter accompanying the crowned performance shall be opened, and the name of the author announced as the person entitled to the said premium.

7. No member of the Society who is a candidate for the premium, then depending, or who hath not previously declared to the Society, that he has considered and weighed, according to the best of his judgment, the comparative merits of the several claims then under consideration, shall sit in judgment, or give his vote in awarding the said premium.

8. A full account of the crowned subject shall be published by the Society, as soon as may be after the adjudication, either in a separate publication, or in the next succeeding volume of their Transactions, or in both.

9. The unsuccessful performances shall remain under consideration, and their authors be considered as candidates for the premium for five years next succeeding the time of their presentment, except such performances as their authors may, in the meantime, think fit to withdraw. And the Society shall annually publish an abstract of the titles, object, or subject matter of the communications so under consideration; such only excepted as the Society shall think not worthy of public notice.

10. The letters containing the names of authors whose performances shall be rejected, or which shall be found unsuccessful after a trial of five years, shall be burnt before the Society, without breaking the seals.

11. In case there should be a failure, in any year, of any communication worthy of the proposed premium, there will then be two premiums to be awarded the next year. But no accumulation of premiums

shall entitle the author to more than one premium for any one discovery, invention or improvement.

12. The premium shall consist of an oval plate of solid standard gold of the value of ten guineas. On one side thereof shall be neatly engraved a short Latin motto suited to the occasion, together with the words: "The Premium of John Hyacinth de Magellan, of London, established in the year 1780;" and on the other side of the plate shall be engraved these words: "Awarded by the A. P. S. for the discovery of——A.D.——." And the seal of the Society shall be annexed to the medal by a ribbon passing through a small hole at the lower edge thereof.

SECTION 2. The Magellanic fund of two hundred guineas shall be considered as ten hundred and fifty dollars, and shall be invested separately from the other funds belonging to or under the care of the Society, and a separate and distinct account of it shall be kept by the treasurer.

The said fund shall be credited with the sum of one hundred dollars, to represent the two premiums for which the Society is now liable.

The treasurer shall credit the said fund with the interest received on the investment thereof, and, if any surplus of said interest shall remain after providing for the premiums which may then be demandable, said surplus shall be used by the Society for making publication of the terms of the said premium, and for such purposes as may be authorized by its charter and laws.

PROCEEDINGS

OF THE

AMERICAN PHILOSOPHICAL SOCIETY,

HELD AT PHILADELPHIA, FOR PROMOTING USEFUL KNOWLEDGE.

VOL. XXX. DECEMBER, 1892. No. 140.

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☞ In order to secure prompt attention it is requested that all correspondence be addressed simply "To the Secretaries of the American Philosophical Society, 104 S. Fifth St., Philadelphia."

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EXTRACT FROM THE LAWS.

THE HENRY M. PHILLIPS' PRIZE ESSAY FUND.

Miss Emily Phillips, of Philadelphia, a sister of Hon. Henry M. Phillips, deceased, presented to the American Philosophical Society, held at Philadelphia for Promoting Useful Knowledge, on October 5, 1888, the sum of five thousand dollars for the establishment and endowment of a Prize Fund, in memory of her deceased brother, who was an honored member of the Society. The Society, at a stated meeting, held October 5, 1888, accepted the gift and agreed

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VOL. XXX. DECEMBER, 1892. No. 139.

On the Mutual Relations Between the Orbits of Certain Asteroids.

By Daniel Kirkwood, Riverside, Cal.

(*Read before the American Philosophical Society, September 2, 1892.*)

The present writer, several years since,* called attention to the fact that in some parts of the asteroid zone the orbits of particular members have a striking resemblance to each other. These significant coincidences have been regarded by astronomers as worthy of study, and, in addition to the binary and ternary clusters pointed out by the writer, others have been designated by Tisserand,† of Paris, and by Monck, of Dublin.‡ These groups, according to the former, cannot be regarded as chance arrangements. "A glance at the list," says Mr. Monck, "will show that the resemblance frequently extends beyond a single pair and embraces what may be called a family—a circumstance which is known to occur in the case of comets also." The writer's list (which might be extended) is as follows:

GROUPS OF ASTEROIDS.

	NAMES.	a	e	i		π	
I.	Huberta ...	3.4586	0.1103	6°	16′	329°	45′
	Hermione ..	3.4535	0.1255	7	36	357	36
II.	(106) Dione.....	3.1670	0.1788	4	38	25	57
	(104) Clymene ...	3.1560	0.1407	2	53	62	30
	(171) Ophelia....	3.1554	0.1142	2	33	148	31
	(62) Erato	3.1241	0.1756	2	12	39	0
	(287) Silesia.....	3.1190	0.1217	3	40	65	16
	(212) Medea	3.1157	0.1013	4	16	56	18
	(86) Semele.....	3.1015	0.2193	4	47	29	10
	(305)	3.0973	0.1927	4	26	104	37
	(345) Vera.....	3.0966	0.1975	5	11	27	48
	(223) Rosa.....	3.0937	0.1206	1	59	106	35
	(268) Adorea.....	3.0853	0.1285	2	25	184	48

*1887. †Annuaire, 1891. ‡ *Sol. Mess.*, October, 1888, p. 334.

	Names.	a	e	i		π	
III.	(238) Hypatia....	2.9081	0.0876	12°	23′	28°	24′
	(191) Kolga.....	2.8967	0.0876	11	29	23	21
IV.	(1) Ceres	2.7673	0.0768	10	37	149	38
	(237) Cœlestina ..	2.7607	0.0738	9	46	282	49
V.	(116) Sirona.....	2.7669	0.1433	8	35	152	47
	(278) Paulina	2.7575	0.1331	7	50	199	52
	(213) Lilaea.....	2.7563	0.1437	6	47	281	4
VI.	(206) Hersilia	2.7339	0.0389	3	46	95	44
	(203) Pompei	2.7376	0.0587	3	13	42	51
	(160) Una.....	2.7287	0.0624	3	51	55	57
	(301) Bavaria	2.7258	0.0660	4	53	24	4
VII.	(97) Clotho	2.6708	0.2550	11	46	65	32
	(3) Juno.....	2.6683	0.2579	13	1	54	50
VIII.	(249) Asporina ...	2.6947	0.1050	15	38	256	6
	(218) Bianca	2.6653	0.1155	15	13	230	14
IX.	(66) Maia	2.6454	0.1758	3	6	48	8
	(37) Fides	2.6440	0.1750	3	7	66	26
X.	(193) Ambrosia ..	2.5758	0.2854	11	38	70	52
	(134) Sophrosyne	2.5647	0.1165	11	36	67	33
XI.	(79) Eurynome .	2.4436	0.1945	4	37	44	22



Further Notes on the Betoya Dialects; from Unpublished Sources.

By Daniel G. Brinton, M.D., LL.D.

(*Read before the American Philosophical Society, October 7, 1892.*)

Last spring the Librarian of the Lenox Library, Mr. Wilberforce Eames, called my attention to a manuscript in that collection, with the following title: "*Arte de lengua de las Misiones del Rio Napo de la Nacion Quenquehoyos, y idioma general de los mas de ese Rio, Payohuates, Genzehuates, Ancoteres, Encabellados. Juntamente tiene la doctrina Christiana en dicha lengua y en la del Ynga. Al remate.*"

It is a duodecimo of seventy-five leaves, complete, clearly written, and dated at the close "Mayo 4 de 1793." It begins with a brief exposition of the grammatic principles of the language, and follows with a vocabulary of about 1700 words, covering 34 leaves. At the close are versions of the Doctrina in the same tongue and in the Kechua. Through the kindness of Mr. Eames I had opportunity to examine the MS. carefully, and to make from it a number of extracts which enable me to present the subjoined sketch of the language.

The stock to which it belongs is one concerning whose grammatic character the material hitherto available has been quite meagre. In a former contribution to the Proceedings of this Society I have shown that what are distinctively known as the Rio Napo dialects belong to the Betoya linguistic stock, and are affiliated with others which can be traced over ten degrees of latitude, from 3° south to 7° north latitude.

The dialect presented in the present MS. is a comparatively pure and well-marked member of the stock, and is nearly related to the Correguage of the head waters of the Caqueta and Putumayo rivers, of which vocabularies have been published by different travelers.

By Hervas, and a number of other writers who have copied from him, these Rio Napo dialects have been classed with the Zaparro stock, with which they have no relationship whatever.

Nouns.

Nouns are usually employed with suffixes denoting relation which allow them to be arranged with a resemblance to declensions.

Following the analogy of the Latin Grammar, the author presents five such declensions of masculine and feminine nouns, with some variations for neuters. The endings of his oblique cases are as follows:

Case Endings.

Declensions.	1.	2.	3.	4.	5.
Genitive,	*co,*	*que,*	*ye, que,*	*ye,*	*he.*
Dative,	*ni,*	*ni,*	*ni, pi,*	*ni,*	*ni.*
Accusative,	*nam,*	*te,*	*te,*	*te,*	*te.*
Ablative,	*pi, pio, nam,*	*pi, pio,*	*pi, pio, ani,*	*pi, are, ani,*	*pi, na.*

The plural is formed by reduplication, or by the general termination *zea* or *cea*, which means "all;" or *guati;* or, for inanimate objects, *na.*

The ablative suffix, *pi* or *pio,* is instrumental; *are* signifies accompaniment.

The termination *na or nam* of the accusative indicates motion.

The following example of a noun of the first declension will be a sufficient illustration.

Sigua-ye—music.

	Singular.	Plural.
Nom.,	*siguaye,*	*siguayezea.*
Gen.,	*siguaco,*	*siguaqunazea.*
Dat.,	*siguaconi,*	*siguanizea.*
Acc.,	*siguaconam,*	*siguatezea.*



animate from the inanimate classes. Nevertheless, such a distinction is clearly recognized in the tongue; and also the distinction between rational and irrational beings.

The termination *pi* indicates animate rational beings, singular or plural; as, *pain pi raye*, some people are coming.

The termination *guati* or *huati* (*guay* or *huay*), is the plural for animate beings, whether rational or irrational, masculine or feminine; as, *Quito huati*, people of Quito, *romi-huati* or *nomio guay*, womenfolk.

The plural termination for inanimate beings is *na;* as, *zonque-na*, the trees.

Other plurals are irregular.

Pronouns.

The same forms serve for both personal and possessive pronouns.

I, my,	*ye* or *ye-pi*.
Thou, thine, thy,	*mve*.
Thou thyself,	*mue-repa*.
That one (masc.),	*ha*, or *an*, or *haon*.
That one (fem.),	*haon*, or *aon-pi*.
She,	*y-o*.
We, our (masc. and fem.),	*may*, or *yeque*, or *yequepi*.
You, your (masc. and fem.),	*musa*.
They, their (masc. and fem.),	*imbue*.

Examples:

My clothing, *ye-ca*.
Thy wife, *mue-rexo*, or *mue-nezo* (from *exhe*, wife).
It is my son, *yeque çiva-e*.

Numerals.

1, *Tey* (masc.); *teo* (fem.); only one, *teirepa* (one itself).
2, *Cayapa*.
3, *Toazumba*.
4, *Cajezea* (2 with plural termination).
5, *Teente* (hand).
6, *Teyentetey* (hand + 1).
7, *Teyente cayapa* (hand + 2).
8, *Teyente toazumba* (hand + 3).
9, *Teyente caesea* (hand + 4).
10, *Caya ente*, or *caya huenã* (two hands).
11, *Caya ente-tey* (two hands + 1).
15, *Toazumba-ente* (three hands).
16, *Toazumba-ente-tey* (three hands + 1).
20, *Caesea ente* (four hands).

Particles.

Like other languages of this class, much of the force of the expression depends on the use of certain particles, employed as prefixes, suffixes or infixes. The following examples will suffice:

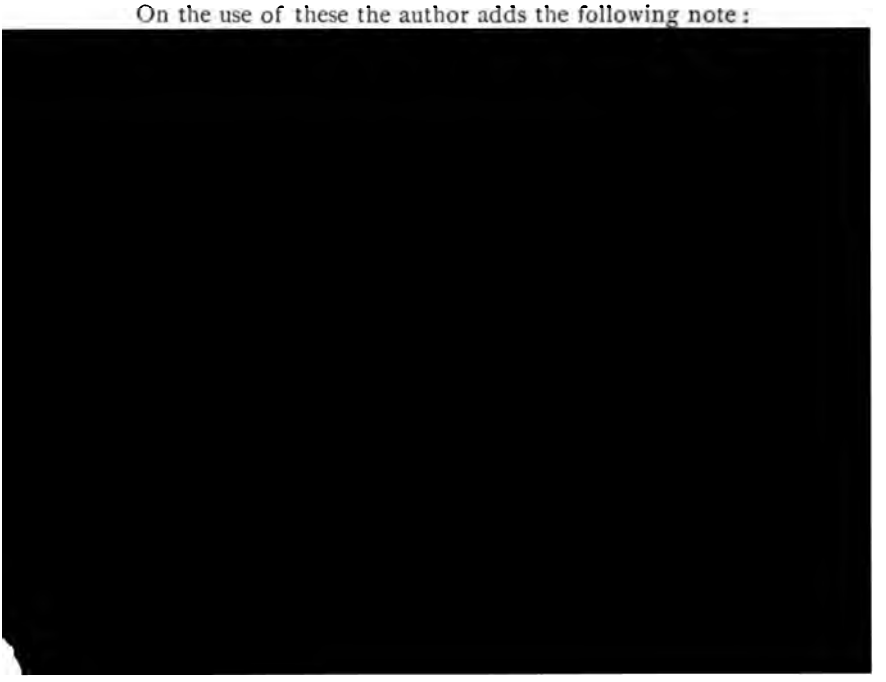
Hua, causative, as, I smell (I observe an odor), *ye ezi*.
I smell (I cause an odor), *ye huazi*.
Eagi, expresses desire or wish.
Cono, to drink; *cono-eagi*, I want to drink.
Caye, has an imperative sense.
Yere, to cut; *yere-e-caye*, to order to cut.
Mapay, indicates negation.
He comes, *rayge;* he comes not, *ray-mapay-ge*.
Que, co, ne, ni are particles of interrogation.

Terms of Consanguinity.

A number of these are given, but their distinction is not well explained.

My father, *ye-aque*, or *hucaque*, or *aqma*.
My mother, *ye-aco*, or *hucaco*, or *acoma*.
My son (child), *ye-mamaque*, fem. *e-mamaco;* or *ye-zenque*, fem. *ye-zenco*.
My grandfather, *ye co-e*, or *nenco-e*.
My grandmother, *ye-coe-o*, or *nenco-o*.
My uncle, *ye-pereque*.
My aunt, *ye-pueco*.

On the use of these the author adds the following note:



PLUPERFECT.

I had loved, *ye oy paa*, etc.

FUTURE.

I shall love, *oysi'ye.*	We shall love, *onui yeque.*
Thou wilt love, *oygen mue.*	You will love, *oini musa.*
He will love, *oysipi yan.*	They will love, *oycipi yan guati*

IMPERATIVE.

Love thou, *oyni'mue.*

Verbs can be formed from nouns or adjectives by adding the particle *gi;* as,

Smoke, *pia;* it smokes, *piagi.*

THE LORD'S PRAYER.

1. *May aque matemote payque.*
   Our father heaven-at is there.
2. *Mue mami oisique pae.*
   Thy name be sacred.
3. *Mue payquero rauyena.*
   Thy kingdom come.
4. *Mue yeye neçique paye.*
   Thy will on earth rule.
5. *Omaje s'ohuay matemote nesique paye.*
   Even as thy holiness in heaven (and) on earth rules.
6. *Aunre yure omansepi mayni insigen.*
   Give to eat to-day as to us each day.
7. *May coayrosere huaneyeyen.*
   Our sins pardon.
8. *Omaje may huanienuu.*
   Even as we pardon.
9. *Tin huati mainre coayocere.*
   Those who us sin against.
10. *Coayoyete mainre tantahe.*
    Doing evil us keep from.
11. *Zea coayete mainpi pirahe.*
    All evils us from deliver.

Notes.

1. *Matemoté* appears to be a locative reduplicated form from *emue*, above; *payque*, to be in a place.

3. *Payquero*, from *pain*, man, master; *quero*, place or town; *rauyena*, from *raye*, to come.

4. The phrase "Creator of heaven and earth" is translated *matemote yejare nesiquete.*

5. The words *neçique paye* seem to be repeated by error.

6. *Aunre*, from *aunne*, to give to eat, derived from *anye*, to eat; *insigen*, from *sia*, day; another word for day is *munçe;* both are evidently from *nçe* or *ense*, sun.

7. *Coayocere*, sins, from *coa* or *qua*, bad.

8. *Huanienuu;* the vocabulary gives *huaneyeye*, to pardon.

10. *Coayoye* or *coayoze*, evils; *coayeteyoye*, to commit sin.

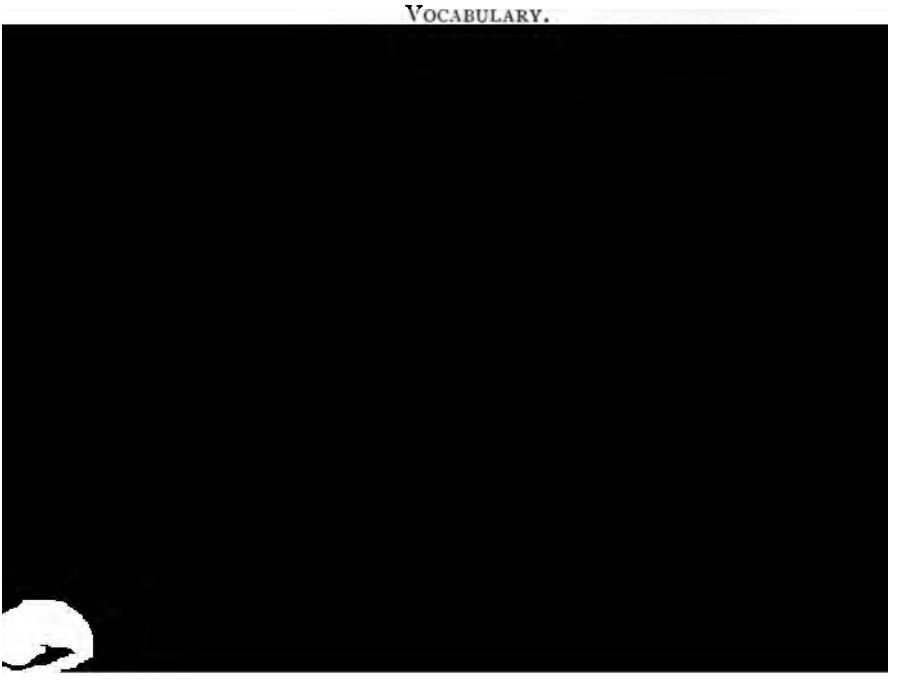
11. *Pirahe*, deliver; so in the Signarse, "Deliver us, O Lord," *mainpi pirahe may aque Dios.*

The following is the version in "Encabellada," given from the Mezzofanti Collection in Teza's *Saggi Inediti de Lingue Americane* (Pisa, 1868):

May ake matemote payque mue mami, oycique paye mue paykero: mayni raygen mue yeye nezique paye exanie yexana, matemote yoygi. Zia omuncepi aunre mayni incigen: may quayeyocere guaniyenigen exanie may quayeyocehuatire guaniyenichañu: quayeyote maypi piraygen ziaqua quachacere mayni rebaygen.

It is evident that this is the same dialect, but a version by a different hand, in which a varied phraseology has at times been adopted.

VOCABULARY.



Ears, *caxoro.*
Eat, to, *anye.*
Egg (raw), *hua jezia.*
(cooked), *quaco jezia.*
Enemy, *juajo pain*, or *guato pain.*
Eyes, *nañqua*, or *nañcoca.*
Face, *zi-a.*
Father (spiritual), *pairi.*
(natural), *jaque*, or *vacaque.*
Feather, *ca.*
Female, *romio*, or *nomio.*
Finger, *monô.*
Fire, *toa.*
to light a fire, *toare zoanŭ.*
Flesh, meat, *huay.*
Flower, *zaza.*
Flute, *hetuhue.*
Foot, *nenye*, or *nencaye.*
Foretell, to (by magic), *viniare caye.*
Forehead, *ziatarapue* (see "Face," "Belly").
Go, to, *zaiye.*
Green, *huaxe.*
Guacamayas, *ma* (= red, from the color of the plumage).
Hamack, *ham*, or *hamxe.*
Hand, *hente.*
right hand, *heja gente.*
left hand, *ari gente.*
Head, *ziumbue.*
Hear, to, *hachaye.*
Heart, *ahue.*
of animals, *zeme.*
of inanimate things, *joyo.*
Heat, burning, *nçe.*
Horn, of animals, *xexo.*
as a wind instrument, *ruruhue.*
Hot, *raca.*
House, *hue.*
new house, *mama hue.*
old house, *punca hue.*
to build a house, *hue enene* (see "To make").
Husband, *eghe*, or *paque*, or *yohemue.*
Image, idol, *toyace.*
Iron, *quena.*
Jar, *qua curo*
Kill, to, *huaye.*
Know, to, *quachaye.*
Lake, lagoon, *zitara*, or *copora*, or *guayra.*
Lance, spear, *huy.*
Light, *toa*, or *zeunze toa* (= fire).
Lion, *mayay.*
Maize, *bea*, or *hueha.*
young, *huinia hueha.*
pounded, *cata vea.*
roasted, *jarose vea.*
Make, to (hacer), *yoye*, or *nene.*
Male, *emue.*
Man, *pain*, or *hain.*
Master, *pague.*
Mat, *punti.*
Milk, *oge.*
Moon, *nianâg*, or *pain.*
the moon shines, *nâneg meagi.*
full moon, *nânà tubetotagui.*
Mother, *aco*, or *bucaco*, or *hacoma*, or *jacore.*
Mouth, *heopo.*
Nail, of finger, *coo.*
Name, *mami.*
Name, to, to call, *cuymiane.*
Navel, *zumjupue.*
New, *mama.*
Night, *nâmi.*
Nose, *uncuepue*, or *aqueeze*, or *un-eye.*
Old man, *aypue.*
Old woman, *a-yo*, or *punq-yo.*
Pardon, to, *huaneyeye*, or *tauye.*
Parrot, *huee.*
People, person, *pain.*
hostile people, *guato pain.*
friendly people, *voi pain.*
Perish, to, *chaye*, or *xuxu chaye*
Place, *rovue*, or *quero*, or *taco*, or *rare.*
Poor, *yehui.*
Pretty, *ayreo*, or *aydeoge.*

Rain, *ôco* (= water).
it rains, *ôcooi*.
Red, *ma*.
bright red, *malay*.
Relation, male, *xoyque*.
female, *xoyco*.
Road, *ma-a*.
Round, *cahua*.
Salt, *hazi*, or *anzi*, or *quena ocha*, or *o-a*, or *teve*.
to salt, *anzi pegenaye*.
Scorpion, *puny*.
See, to, *inaye*.
Seed, grain, *ca*.
Servant, slave, *joya*.
Shaman, priest, *viniapain* (see "To foretell").
Shoulders, *ete*.
Silver, *rehua*.
Sin, *coa-yoye* (see "Bad").
Sleep, to, *cane*.
Smell, to, *yeye-ye*.
Small, little, *arimania*.
Smoke, *pia*.
Soul, *joyo* (see "Heart").
Spittle, *co-o*.
Spring, fountain, *oco reaia* (see "Water").
Star, *manáco*.
the Pleiades, *vze po*.
Stick, *tarapue*.
Stone, *quena*.
Straw, *taya juinze*.
Sun, *nçe*, or *ense*.
the sun rises, *nçe nantagi*.
Talk, to, *n-caye*, or *cocacaye*.
speech or words, *caye*.
language, *coca*.
Thief, *naaque*.
Tiger, *ayro-yay* (see "Woods," "Dog").
Time, *rem*.
Tobacco, *mueto*.
in powder, *xea*, or *xena mueto*.
To-day, *yure*.
Tongue, the, *zemeno*, *zemeyo*.
Town, village, *quero*, or *taco*, or *raripue* (see "Place").
Turtle, *cohue*, or *puca*, or *tazeya*.
Urine, *cone*.
Water, *ôco*.
drinking water, *ocoraca*.
clear water, *cositaye oco*.
Weight, *requexi*.
to weigh in a balance, *cuencuesi*.
Wind, *tutu*.
Wish, to, *yeye*.
White, *poo*.
Woods, forest, *ayro*, or *muc*.
Yellow, *zeno*, *zonio*, or *paco*
Yesterday, *niamina*.

On the Phylogeny of the Vertebrata.

By E. D. Cope.

(*Read before the American Philosophical Society, October 7, 1892.*)

I have traced the origin* of the Mammalia to the Theromorous reptiles of the Permian epoch, for the following reasons. The latter include the Pelycosauria, Cotylosauria, Procolophonina and perhaps other orders. In both classes there is only one postorbital arch of the skull, and this is the zygomatic. In both (excepting Prototheria and Procolophonina†)

* Proceeds. Amer. Philos. Soc., 1884, p. 13.
† Seeley, Philos. Trans. Royal Soc., 1889, 259.

the coracoid element is of reduced size, and is coössified with the scapula. In both (except Cotylosauria) the capitular articulation of the ribs is intercentral. In both, the humerus has distal condyles and epicondyles, and there is an entepicondylar foramen in the Pelycosauria as in the lower Mammalia. The posterior foot is constructed in the Pelycosauria almost exactly like that of the Prototheria. The single occipital condyle of the reptiles is not found in the Mammalia, but in some of the Lacertilia (Uroplates, Gecco) there are two condyles, the median (basioccipital) portion of the single condyle being rudimental. The Pelycosauria could not, however, have given origin to the Prototheria, since in that subclass of mammals there is a well-developed coracoid. But in the Procolophonina this element is developed as in the Prototheria. Moreover, the Pelycosauria and the Procolophonina have the interclavicle, which is an element of membranous origin, while in the Prototheria we have the corresponding cartilage bone, the episternum. This element is present in the Permian order of the Cotylosauria, which is nearly related to the Pelycosauria. This order has, however, single-headed ribs, springing from the diapophyses, which is not usual in the Mammalia. But in some Cotylosauria the diapophyses are short, and in the Monotremata the postcervical ribs are single-headed, so this character may not prove an insurmountable one. It is evident that the Mammalia were derived from some type probably referable to a Permian reptilian order of the Theromorous series, although to which one is not yet known.

The Reptilia have been supposed by Hæckel to have taken their origin from the Batrachia. I have indicated that it is probable that the Batrachian order, which stands in this relation to the Reptilia, is the Embolomeri of the Permian epoch. This conclusion rests on the following considerations. The Reptilian order of the Cotylosauria approaches the Batrachia of the subclass Stegocephali in the overroofing of the posterior regions of the skull ; in the presence of vomerine teeth, and in the absence of obturator foramen of the pelvis. In some Cotylosauria (Diadectidæ) the stegocephalian intercalary bone of the skull is well developed. But in the Cotylosauria, the vertebral column consists mainly of centra, while in the Stegocephali it consists entirely or partly of intercentra. But in the Embolomeri the centra are well developed, and are larger than the intercentra anterior to the pelvis. Hence this is the only order of Stegocephali from which the Reptilia could have been derived.

Hæckel derived the Batrachia from the Dipnoi (Dipneusta), and I followed him in this belief, being strengthened in it by Huxley's ascription of an autostylic suspensorium of the mandible* to both divisions. This phylogeny is questioned by Pollard† and by Kingsley‡ who would see the ancestry of the Batrachia in the Crossopterygian fishes on embryological grounds derived from a study of Polypterus. In support of their

* Proceedings Zoölogical Society of London, 1876, p. 59.

† Anatomischer Anzeiger, vi, p. 338, 1891.

‡ American Naturalist, 1892, p. 679. Kingsley would also derive the Dipnoi from Crossopterygia.

view I would cite the absence of the maxillary arch in the Dipnoi, and its full development in the Stegocephali, which are the ancestral Batrachia. The large development of the dorsal and anal fins in the Dipnoi is not favorable to the Hæckelian view; nor do the paired fins approach as nearly to the limbs of Batrachia as do those of some other fishes. It has been shown by Huxley that the suspensorium of the Batrachia is hyostylic in its earliest stages, and that it becomes autostylic at a later period of development. The Batrachia may then have originated from a hyostylic Teleostomous fish; *i. e.*, one with complete maxillary arch. Among Teleostomata we naturally look for forms with limbs which approach nearest the Batrachian type, and in which median fins are feeble or wanting. Such are the Rhipidopterygia, which include the families of Holoptychiidæ, Tristichopteridæ, Osteolepididæ, Cœlacanthidæ and perhaps some others. These families, except the last, abounded in the waters of the Devonian period, at the time when the ancestors of the Batrachia also



segmentation, the basioccipital element being conspicuous. The fins are all primitive, and those of all other types of fishes might have been derived from them. Opposed to this estimate of their relation to other vertebrates is the fact that they have not been yet found prior to the Carboniferous period. But our knowledge of the fishes of the Devonian is yet very imperfect. The types ancestral to the Pisces must have existed in the Silurian, and forms which may well have fulfilled this function have been discovered there. I refer to the Agnatha, which have been traced to the summit of the Devonian. The Silurian Agnatha are the Pteraspididæ, which display the lowest type, and the Cephalaspididæ, and these were succeeded by the Pterichthyidæ in the Devonian. There is a wide gap between these forms and any of the fishes, and nothing can be affirmed plausibly with regard to the phylogeny. There are superficial resemblances between the dorsal and ventral dermal scuta of the Pterichthyidæ and the Arthrodirous Dipnoi, but there is no considerable affinity between those divisions.

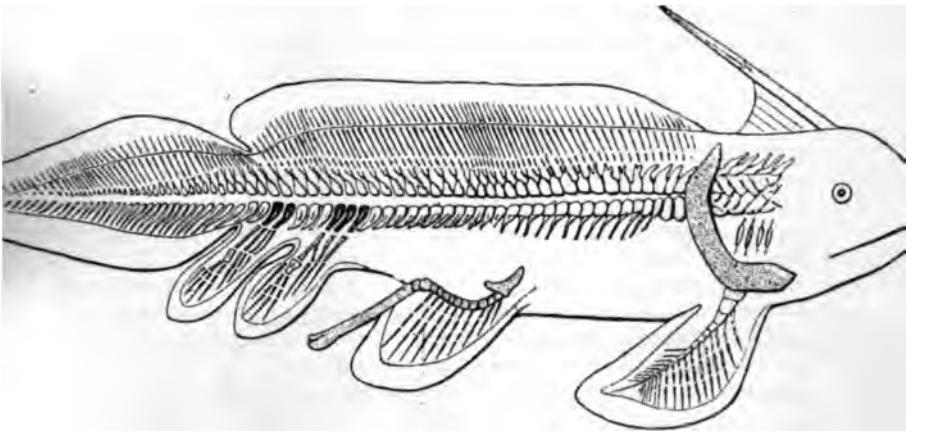


Fig. 2. *Xenacanthus dechenii*, one of the Ichthyotomi; restored by Dr. H. E. Sauvage. From the Coal Measures of France.

The extinct Agnatha agree with the existing lampreys in the absence of lower jaw and pectoral (scapular) arch, and both must be traced, in accordance with Hæckel's phylogeny, to the Acrania, which is now represented by the amphioxus (genus Branchiostoma). This order is easily the ancestor of existing Vertebrata, and shows points of resemblance to both Tunicata and worms. It has been suspected by Dohrn to have undergone degeneration, which may have been the case, since this phenomenon is so abundantly exhibited by both Tunicata and worms. It is not difficult to believe with Kowelewsky, that the Acrania were derived from the Tunicata. Semper has suspected, on the other hand, that the ancestors of the Vertebrata are to be found in the Annelide worms.

On Some Points in the Kinetogenesis of the Limbs of Vertebrates.

By E. D. Cope.

(*Read before the American Philosophical Society, October 7, 1892.*)

The following paper is designed to supplement some omissions from my previous discussion of this subject in the memoir "On the Mechanical Causes of the Origin of the Hard Parts of the Mammalia."*

I. The Segmentation of the Chiropterygium.

The segmentation of the limbs in the Vertebrata is a simple mechanical problem. Paleontology and embryology concur in proving that the limbs originated in primitive folds in the external integument, and that their connection with the internal skeleton was of later accomplishment. At first free, they sought points of support on the skeleton, but did not lose their free mobility when this contact was attained. Appropriately to the mechanical conditions of rigidity and flexibility necessary to their use in a fluid medium, they were originally composed of slender rods which were segmented by interruptions at suitable points. The articulations of the fin rays of fishes have been made the subject of an interesting research by Ryder, who finds them to be fractures, due to flexures during motion in the water medium.† The limb of land vertebrates (the chiropterygium) was derived from one of the forms of fins (rhipidopterygium) of water vertebrates. This is the simple type of primitive fin displayed by the Paleozoic Teleostomi of the superorder Rhipidopterygia. Whether the subdivisions of the chiropterygium, the propodial, metapodial and



the knee forwards. This diversity is clearly due to the diverse positions of the functioning regions. The opposite extremities of the alimentary canal, the posterior including the exits of the urogenital organs, requires that the fore limbs should bend forwards, and the posterior limbs backwards. And the constantly recurring necessity for the exercise of these flexures must necessarily have developed the appropriate articulations in preference to all others. The terminal flexure, that of the wrist or ankle, has been evidently due to a similar mechanical cause; viz., the flexure due to pressure of the weight of the body on the terminal segments when in contact with earth. The distal segments are the most slender in all types, and least able to maintain a linear direction under pressure, hence, they have flexed easily and thus the line of separation between leg and foot had its origin.

II. The Origin of the Crests of the Humeral Condyles.

I have already pointed out (*op. cit.*) the kinetogenetic origin of the tongue and groove articulations in the Mammalia.

An excellent example is furnished by the elbow joint of the Quadrumana and Diplarthra. In the lower Mammalia, including the Carnivora (*op. cit.*, Pl. ix, fig. A), the distal end of the humerus presents a submedian groove which receives the ulna, and on the inner side of it, a more or less convex surface, which is applied to the head of the radius. The coronoid process of the ulna is narrow and its dense bounding walls impinge on the broad face of the humeral condyle in flexion and extension, and transfers to it the force of impact when the foot strikes the ground. In either case, strong pressure has been brought to bear on the humeral condyle and it has yielded to the denser body of the ulna, thus forming the groove in question. In such Mammalia, the effect of the head of the radius on the humeral condyle has been similar and in the same direction, *i. e.*, upwards. The dense edges of the former have impressed themselves on the latter, while the unsupported middle portion has yielded in the direction of gravity, and the result is what we find, *i. e.*, a cup-shaped surface of the head of the radius, and a convexity of the humeral condyle, adapted to it.

Among specializations of the elbow joint, I call attention to two. In the Quadrumana, the head of the radius, probably owing to continued supination of the manus, occupies a position at the external side of the coronoid process of the ulna, and impinges on the outer part of the condyle of the humerus. The concavity of its head and the convexity of the humeral condyle are visible as before, but a prominent tongue or keel, which has been called the intertrochlear crest, separates the ulnar and radial surfaces of the humerus. (Fig. B). This keel occupies the groove or interval which separates the head of the radius from the coronoid process of the ulna. It is plain that we have here another tongue and groove joint, produced by the mutual adaptation of parts, under strain, pressure and impact. The other extreme of elbow joint is found in-

that of the diplarthrous Ungulata (Fig. E). Here the head of the radius, while retaining its normal position on the inner side of the forearm, is extended to the external side of the ulna and even beyond it, adapting itself to the entire width of the humeral condyles. The same structure is found in the specialized forms of both series of Diplarthra, the Perissodactyla and Artiodactyla. This expansion of the head of the radius appears to be in direct relation to the duration through long geologic ages of the impacts which have affected the limbs of these, the swiftest of the Mammalia. That the head of the radius should be spread so as to fit the entire surface of the humerus as an effect of continued impact, seems to be a mechanical necessity. But in addition to this we find a tongue-and-groove adaptation in which the crest (which I have called the trochlear crest), articulates with a groove in the head of the radius. The internal articulation of the humerus with the radius has the usual form, convex and concave distad. The trochlear crest marks the external border of the olecranar groove of the humerus. But the external part of the humeral condyles is converted into a roller which is set off from the trochlear crest, by the abrupt contraction of its diameter ; while the corresponding part of the head of the radius projects to fit it exactly.

A probable explanation of the form of this roller may be derived from a consideration of the almost identical structure of the metapodio-phalangeal articulation in the Artiodactyla. The internal and external sides of the distal metapodial condyles are not similar ; a character very distinct in the Artiodactyla (Fig. E). This is simply due to the unequal pressure exerted on the two extremities of the condyle by the phalanges, owing to the divergent direction of the digits when serving as a support. In the distal end of the humerus, the same effect is seen, the external part of the condyle nearly resembling the corresponding part of the meta



ported by the external bones of the carpal and tarsal series respectively. The reduction of the external digit deprives the external bones in question of their share in the support of the general weight, and consequently relieves them of impact, which now passes through the longer median digits which remain. The median digits, on the other hand, support the radius and tibia through the medium of the carpus and tarsus, and it is these elements, therefore, which function in the use of the limb. We have here an evident illustration of the effect of disuse in effecting the atrophy of an element, and of use in increasing the size and complexity of an adjacent element of the same organism. No other explanation seems possible, for the elements which are reduced and those which are enlarged are subjected in every other respect to the same conditions.

On False Elbow Joints.

By Prof. E. D. Cope, Ph.D.

(*Read before the American Philosophical Society, December 2, 1892.*)

I have in various papers formulated and defended the hypothesis that the peculiar characters of the articulations of the mammalian skeleton are due to mechanical causes operating throughout the ages of geologic time.* I had previously traced the succession of these modifications from simple reptilian types, through various stages, to the highly specialized and mechanically perfect structures seen in the higher Mammalia. The series of forms revealed by paleontologic research is so complete as to leave little doubt in the mind as to the manner and cause of their origin. The theory thus derived, which I have called kinetogenesis, depends for its demonstration on two assumptions. The first is that living osseous tissue is plastic, and is therefore readily modified in its form by impacts, strains, friction, etc.; and the other is that one which is necessary to all evolutionary hypotheses, that acquired characters are inherited. I do not propose to discuss here the latter proposition, but I desire to offer some evidence in support of the former. Marey tells us,† as a result of a study of pathological conditions of articulations, that "after dislocations the old articular cavities will be filled up and disappear, while at the new point where the head of the bone is actually placed, a fresh articulation is formed, to which nothing will be wanting in the course of a few months; neither articular cartilages, synovial fluid, nor the ligaments which retain the bone in place."

Specimens demonstrating the truth of this statement of Marey are also

* *Origin of the Fittest*, 1887, p 368 *et seq.*; "The Mechanical Origin of the Hard Parts of the Mammalia," *American Journal of Morphology*, 1889, p. 148.

† *Animal Mechanism*, 1874, pp. 88, 89.

demonstrative of the truth of the doctrine of kinetogenesis. Two such have recently come under my observation—both of them cases of dislocation of the elbow joint. One of these is that of a man (No. 1838, Wistar and Hornor Museum of the University of Pennsylvania), where the cubitus is luxated backwards. The other is that of a horse, where the cubitus is luxated outwards, which I owe to the kindness of Dr. William B. Werntz, Vet., of Philadelphia. These specimens are especially instructive as exhibiting the different effects of different luxations of the same articulation.

Elbow of Man.

The human elbow, for which I am indebted to the authorities of the University of Pennsylvania, is so dislocated as to have allowed little flexion and extension during life, but the radius retained rotary motion. The humeral condyle rests on the ulna anterior to the coronoid process, and the head of the radius is in contact with the posterior side of the external epicondyle. It has resulted in consequence of the abnormal position of the humerus, that a new coronoid process has developed as far anterior to the true coronoid as the latter is anterior to the olecranon; and that a new humeral cotylus has appeared between the two coronoids whose fundus is considerably elevated above that of the old one. In consequence of the contact of the head of the radius, a deep cotylus has been formed on the posterior face of the external epicondyle and adjacent part of the condyle of the humerus, which is well adapted to the radial head. From both of these new cotyli I removed a layer of articular cartilage, and the osseous surface is as smooth and dense as those of normal articulations. The edges of the cotyli are not as smooth as those of the normal, but display the greater or lesser irregularities of



Elbow of a Horse.

I am informed by Dr. Werntz that the horse with dislocated elbow lived for about two years after the accident, in the country, dying of pneumonia. It used the leg (the left one) to a moderate degree, walking on the extremity of the hoof, with the elbow everted.

It results from the dislocation, that the internal part of the head of the radius was in life without opposing humeral surface. The trochlear crest of the humerus rotated inside of the median ridge of the head of the radius; and the interior roller of the humerus projected freely within the internal border of the head of the radius. The external border of the humeral condyles corresponds to the trochlear groove of the head of the radius, which, of course, it does not fill. Since the internal face of the olecranar process rotates on the external epicondyle of the humerus, it follows that the external face of the olecranar process has no contact and was unused.

The mechanical result of this position of the parts is as follows: The internal side of the olecranar process develops friction on the external surface of the external epicondyle of the humerus. The trochlear crest of the humerus produces the same along the inner side of the median crest of the head of the radius. The expansion of diameter of the internal roller of the humerus produces friction on the internal edge of the head of the radius.

The structural result may be divided into two divisions: *first*, those developed at points of contact of the parts thus abnormally brought together, and *second*, those which appear at points abnormally separated.

Class First. (1) A large new facet is developed on the posterosuperior aspect of the external epicondyle of the humerus (*1a*, Figs. 1 and 3), which lies in an arc continuous with that of the external roller (or condyle), and whose surface is directed downwards and outwards. It occupies the usual position of the external *flexor metacarpi* muscular insertion, which is in the normal humerus a truncate oval, looking downwards and backwards. This surface has been almost entirely removed, the posterior face of the lateral rib of the humerus terminating below in an obtuse acumination, instead of the form described. The form of the new facet is not entirely due to the planing down or absorption of this region. The external epicondylar fossa is filled with exostoses, of which a large one in a superior position contributes material for the inferior part of the new facet. The posterior rib of the humerus is also exostosed so as to present a rough surface of greater transverse extent than in the normal humerus. This mass overhangs the new olecranar facet, forming a guide to its free extremity in rotation, the latter thus running in an open groove. Thus is further luxation in a measure provided against.

(2) The internal half of the humeral facet of the olecranar process is narrowed, and its prominent internal rim rounded off; and it is con-

tinued to the radial articular surface, instead of being separated by an interruption as seen in the normal horse. In extension and flexion the prominent posterior border of the new olecranar facet of the humerus rotates behind the humeral olecranar facet just described. Posterior to this depressed surface there rises an abnormal bony crest which is concentric with the olecranar and humeral surfaces, and serves as a guide in extension and flexion of the crest of the humerus which moves in the surface in front of it, which becomes, through the presence of this crest, an open groove (*1c*, Figs. 4, 5).

(3) A triangular shallow facet is formed on the posterior part of the head of the radius corresponding to the trochlear crest of the humerus (*1f*, Figs. 2, 4).

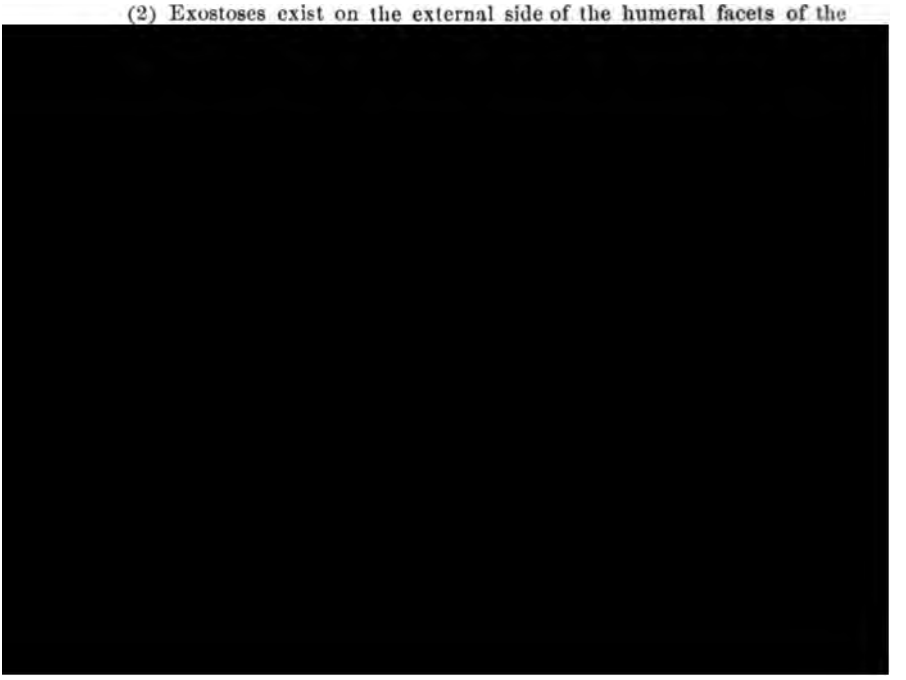
(4) A corresponding facet appears on the posterior part of the trochlear crest of the humerus, which penetrates the dense layer (*1e*, Fig. 1).

(5) The internal extremity of the humeral surface of the head of the radius is beveled off by the expansion of the internal roller of the humerus, forming a new facet of perfect articular character (*1b*, Figs. 1, 2, 4).

(6) A facet corresponding to (5) is developed on the internal roller at its middle, considered either transversely or anteroposteriorly. It is of an elongate oval form, and its superior portion penetrates the dense layer (*1d*, Fig. 1).

Class Second. (1) The trochlear groove of the head of the radius has nearly closed its anterior and posterior margins by osseous outgrowths, the largest of which, the posterior, so fills it as to support the external part of the external humeral condyle in extension and flexion (*2a*, *2b*, Figs. 2, 4, 6).

(2) Exostoses exist on the external side of the humeral facets of the



continued would have extended the head of the radius for adaptation to the inwardly luxated humerus.

ETIOLOGY.—That the new structures described are due to the abnormal mechanical relations of the bones, will be questioned by no one. We observe three distinct processes of osseous metabolism due to these conditions. These are: *First*, the removal of tissue from its original locality, and the substitution of dense tissue for spongy tissue at the point of removal. This has been accomplished at three points. A. Where the inferior extremity of the external posterior rib of the shaft of the humerus has been largely cut away, in adaptation to the movement of the olecranar crest of the ulna, and a dense layer developed over the new surface thus produced. B. Where the internal border of the head of the radius has been beveled off. C. Where the internal face of the humeral facet of the olecranar process of the ulna has been planed down without exposing the spongy bone. That this process was not completed at some points is shown by the two new facets of the humeral condyles, where the dense layer is penetrated and no corresponding dense layer established on the spongy layer thus exposed (Figs. *1d* and *1e*).

Second. The deposit of osseous bodies beneath the synovial walls where the bursa was kept expanded by the failure of the articular ends of the bones to maintain contact, as in the case of the trochlear groove of the head of the radius, and the external side of the humeral facet of the olecranar process of the ulna.

Third. The development of exostoses at the insertions of articular ligaments and tendons at the following three points: A. At the insertion of the *flexor metacarpi externus* ligament, at the exterior border of the posterior face of the inferior end of the shaft of the humerus, which crest overhangs the new facet above described. B. Where the osseous crest is developed on the ulna, concentric with the interior humeral facet of the olecranar process. C. Where extensive exostosis appears on the internal side of the head of the radius. D. Where the external epicondylar fossa is filled with exostoses (other ligamentous exostoses at 3*e*, *f* and *g*, Figs. 1, 2, 4, 5).

From the above analysis we may derive the following conclusions as to the nature of the metabolism in the several cases:

Class First Continued excessive friction removes osseous tissue from the points of contact until complete adaptation is accomplished and the friction is reduced to a normal minimum.

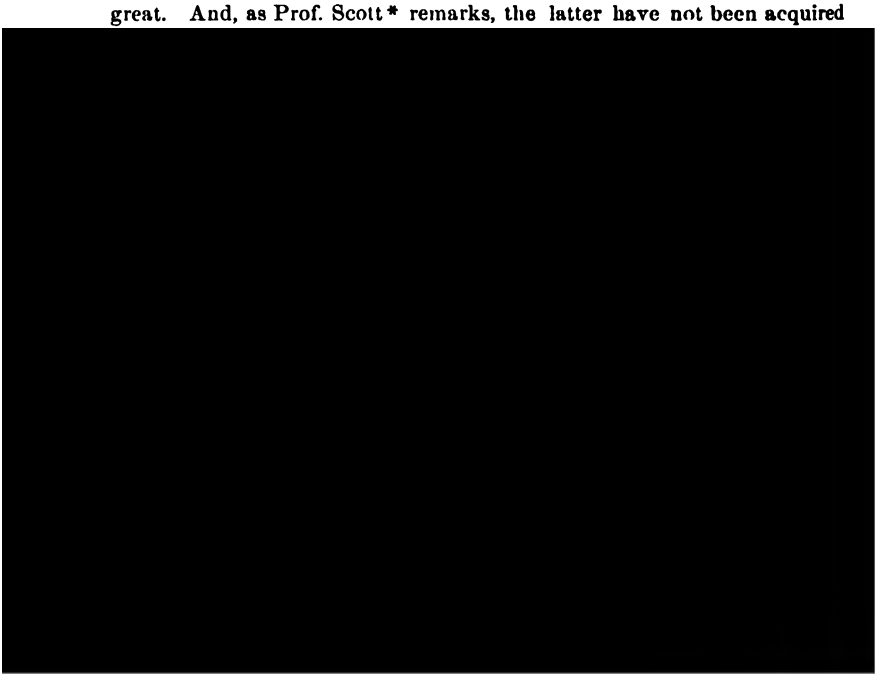
Class Second. Where the normal friction is wanting, and an inflammatory condition is maintained by a pulling stress on the investing synovial membrane, excess of osseous deposit is produced.

Class Third. Stress on the articular ligaments and tendons stimulates osseous deposit at their insertions, which deposit may be continued into their substance. This is a pulling stress.

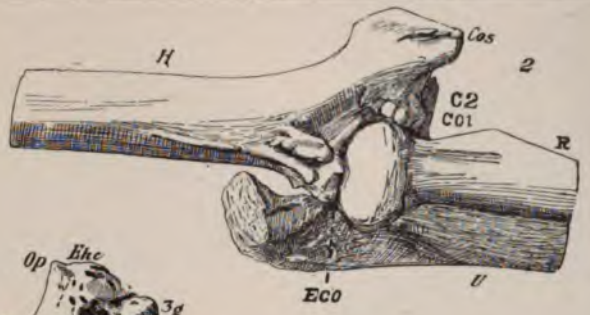
CONCLUSIONS.—We find illustrated in these specimens three kinds of osseous structures which are observed in normal vertebrate skeletons.

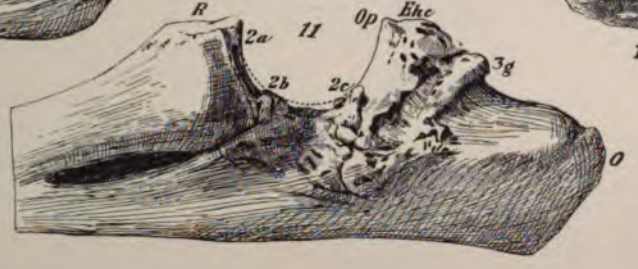
These are, articular facets, osseous deposit at presumed points of irritation from various stimuli, and the development of bone at ligamentous and tendinous insertions. To the combination of the causes which produce the first and second effects we owe most of the secondary peculiarities of the vertebrate skeleton; and to the third we owe the fundamental construction of the skeleton on which the secondary modifications have been superposed. It is not important to our contention if the histological structure of some of the abnormal osseous deposits in our specimen may differ slightly from the normal tissues sought to be explained by it. This may be accounted for by the different circumstances to which the two sets of phenomena are due. In the dislocation the change from the antecedent state of the parts is violent and abrupt. In the evolution of the vertebrate skeleton the process was slow and gradual. In the cases of the luxations nature had to meet the changed conditions by correspondingly abnormal measures. In orderly evolution "*saltus non fecit.*" It may, however, be justly inferred, that if such characteristic structures can be produced in the space of months, how much more easy has it been for stimuli of allied character to develop the features of normal articulations during the ages of geologic time.

We have here, also, an instructive lesson as to the matter of inheritance. Every one knows that mutilations, luxations, etc., are not usually inherited. This is because they are not "acquired" in the proper sense of the word. Since characters truly acquired are inherited, it is evident that a long continuance of the stimulating cause is necessary to produce a true acquisition. The difference between a character produced by causes apart from the normal life of an animal and not repeated, and those produced by causes operating daily and hourly for geologic ages, is necessarily very great. And, as Prof. Scott* remarks, the latter have not been acquired



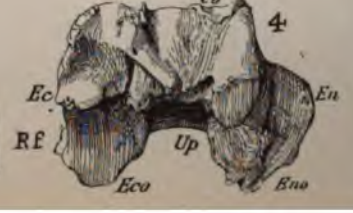

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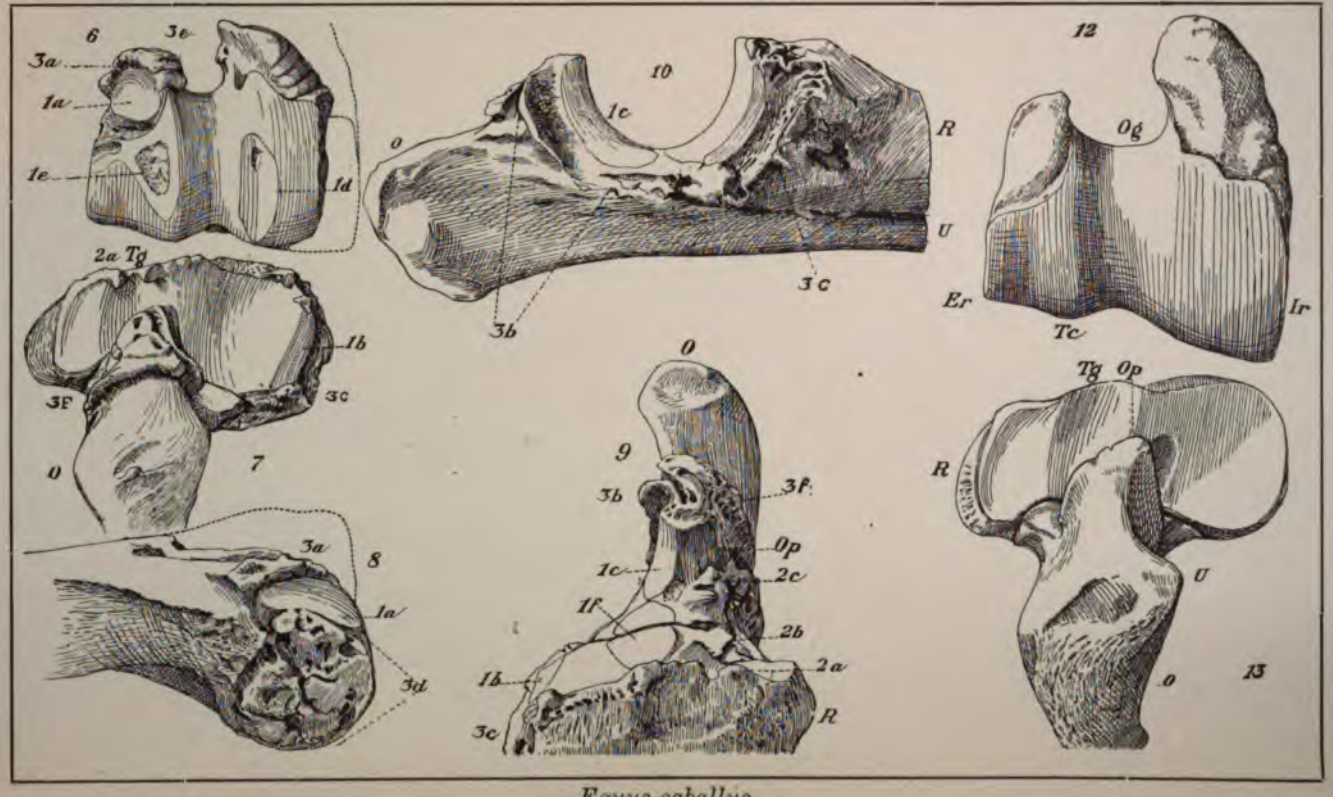

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Equus caballus.

inferior condylar exostosis; *Hf*, humeral facet; *Rf*, radial facet; *Uf*, ulnar facet.

Figs. 6–11. Bones of abnormal left elbow joint of horse; one-half natural size.
12, 13. Normal bones of elbow joint of horse; one-half natural size.
6–12. Humerus, distal views.
7–13. Cubitus, proximal views.
8. Humerus, external view of distal extremity.
9. Humeral articulation of cubitus, from above.
10. Cubitus, internal view.
11. Cubitus, external view.

Additional lettering.—*Op*, olecranar process of ulna; *Cp*, coronoid process of ulna; *Og*, olecranar groove of humerus; *Tc*, trochlear crest of humerus; *Tg*, trochlear groove of humerus; *Ehc*, external humeral facet of coronoid process; *Ihc*, internal humeral facet of coronoid process.

The lettering of the abnormal facets and exostoses in Figs. 6–11 conforms to that of the same in the etiological classification on page 289.

Stated Meeting, September 2, 1892.

Present, 3 members.

President, Mr. FRALEY, in the Chair.

The decease of the following members was announced:

M. F. Longstreth, Sharon Hill, Pa., December 27, 1891, æt. 73.

H. Burmeister, Buenos Ayres, May 6, 1892, æt. 86.

John R. Baker, Philadelphia, June 22, 1892, æt. 74.

George William Curtis, New York City, August 31, 1892, æt. 68.

Correspondence was submitted as follows:

A letter accepting membership from Mr. Joseph D. Potts, Philadelphia, dated May 24, 1892.

A letter acknowledging receipt of diploma from Dr. Caspar René Gregory, Leipzig.

A circular from the R. Accademia delle Scienze di Torino,

announcing the death of its Vice-President, Prof. Comm. Giovanni Flechia, June 3, 1892.

A circular from the Committee for the Erection of a Monument to the Memory of M. A. de Quatrefages, inviting subscriptions for that purpose.

A circular from the Royal Society of N. S. Wales, offering its medal and £25 for the best communication containing the results of original research or observation upon the various subjects named.

An invitation from the Buffalo Historical Society to the unveiling of the statue of Red Jacket, erected by that Society, to take place June 22, 1892.

An invitation from the Deutsche Anthropologische Gesellschaft, to attend the Twenty-third Congress, to take place at Ulm, August 1 to 3, 1892.

A circular from the American Chemical Society, New York, announcing the Fifth General Meeting, to be held at Rochester, N. Y., August 16 and 17, 1892.

A program of meetings and excursions of the Sixth Session of the Congrès Géologique International, to take place at Zurich, in 1894.

Announcement of the Tenth Session of the Congrès Inter-



Sciences, Throndhjem; Université Royale, Lund, Sweden; Musée Teyler, Harlem, Holland; Maatschappij der Nederlandsche Letterkunde, Leiden, Holland; Naturforschende Verein, Brünn, Austria; K. Akademie der Wissenschaften, Berlin; K. Sächsische Gesellschaft der Wissenschaften, Leipzig; Gesellschaft zur Beförderung der gesammten Naturwissenschaften, Marburg; Centralbureau der Internationalen Erdmessung, Potsdam, Prussia; Altertumsverein für Zwickau und umgegend, Zwickau, Saxony; École Polytechnique, Bureau des Longitudes, Musée Guimet, Paris; Meteorological Office, Royal Statistical Society, London, Eng.; Royal Irish Academy, Dublin; Geological Survey of Pennsylvania, Harrisburg; U. S. Fish Commission, Washington, D. C.; University of Wisconsin, Madison.

Letters of acknowledgment (Transactions xvii, 1 and 2) were received from the Observatoire Physique Central de Russie, St. Petersburg; Geological and Natural History Survey, Ottawa, Canada; Museum of Comparative Zoölogy, Cambridge, Mass.; American Antiquarian Society, Worcester, Mass.; Yale University, New Haven, Conn.; State Library, Albany, N. Y.; Buffalo Library, N. Y. Historical Society, New York; New Jersey Historical Society, Newark; Academy of Natural Sciences, Franklin Institute, Library Company, Philadelphia; U. S. Geological Survey, Washington, D. C.; University of California, Berkeley; California Academy of Sciences, San Francisco; State Historical Society of Wisconsin, Madison.

Letters of acknowledgment were received from the Institut Egyptien, Cairo (135); R. Society of N. S. Wales, Sydney (135); I. Academy of Sciences (136, 137), Russian Chemical Society, St. Petersburg (136); Observatory, Taschkent (136); Université Royale, Lund, Sweden (132–136); Société Hongroise de Geographie, Budapest (136); K. K. Central Anstalt für Meteorologie, etc. (137), K. K. Naturhistorisches Hofmuseum (136), Prof. Franz v. Hauer (134–137), Dr. Frederick S. Krauss (134–136), Drs. M. Much, Frederick Müller (136), E. Suess (135, 136), Vienna, Austria; Naturforschende Gesell-

Society, Mathematical Society, Astor Library, American Museum Natural History, University of the City of New York, "Popular Science Monthly," Prof. J. A. Allen, Messrs. James Douglass, R. W. Raymond, New York; Vassar Brothers' Institute, Poughkeepsie, N. Y.; Geological Society of America, Rochester, N. Y.; U. S. Military Academy, West Point, N.Y.; Prof. Henry M. Baird, Yonkers, N. Y.; Mr. Isaac C. Martindale, Camden, N. J.; Free Public Library, Jersey City, N. J.; New Jersey Historical Society, Newark; Prof. C. A. Young, Princeton, N. J.; Oneida Historical Society, Utica, N. Y.; Dr. Robert H. Alison, Ardmore, Pa.; Prof. Charles F. Himes, Carlisle, Pa.; Hon. Eckley B. Coxe, Drifton, Pa.; Prof. M. H. Boyé, Coopersburg, Pa.; Profs. Trail Green, Thomas C. Porter, J. W. Moore, Easton, Pa.; Mr. Andrew S. McCreath, Harrisburg, Pa.; Prof. Lyman B. Hall, Haverford, Pa.; Mr. John Fulton, Johnstown, Pa.; Linnean Society, Lancaster, Pa.; Prof. John F. Carll, Pleasantville, N. J.; Rev. F. A. Mühlenberg, Reading, Pa.; Rev. G. W. Anderson, Rosemont, Pa.; Dr. John Curwen, Warren, Pa.; Mr. Philip P. Sharples, Hon. Washington Townsend, Philosophical Society, West Chester, Pa.; College of Physicians, Academy of Fine Arts, Historical Society of Pennsylvania, Library Company of



Smithsonian Institution, U. S. Geological Survey, U. S. Coast and Geodetic Survey, Anthropological Society, Surgeon General's Office, Patent Office, Weather Bureau, Mr. W. B. Taylor, Dr. W. J. Hoffman, Profs. S. F. Emmons, C. V. Riley, Charles A. Schott, Washington, D. C.; University of Virginia, Prof. J. W. Mallet, Charlottsville, Va.; Mr. Jed. Hotchkiss, Staunton, Va.; Agricultural Experiment Station, Prof. I. C. White, Morgantown, W. Va.; Georgia Experiment Station, Experiment; Georgia Historical Society, Savannah; University of Alabama, Tuscaloosa; Agricultural Experiment Station, Baton Rouge, La.; Prof. J. C. Branner, Palo Alto, Cal.; University of California, Berkeley; Lick Observatory, Mt. Hamilton, Cal.; Prof. Daniel Kirkwood, Riverside, Cal.; Prof. E. W. Claypole, Akron, O.; Ohio Archæological and Historical Society, Columbus; Cincinnati Observatory, O.; Davenport Academy of Natural Sciences, Iowa; State University, Iowa City, Iowa; Prof. J. L. Campbell, Crawfordville, Ind.; Purdue Experiment Station, La Fayette, Ind.; University of Michigan, Ann Arbor; Michigan Agricultural College, Ingham Co.; Geological Survey of Missouri, Jefferson City; Prof. Herman Haupt, St. Paul, Minn.; State Historical Society of Wisconsin, Madison; Kansas State Historical Society, Topeka; Agricultural Experiment Station, Manhattan, Kans.; Agricultural College of New Mexico, Las Cruces; Observatorio Astronómico Nacional Mexicano, Tacubaya; Don Mariano Barcena, Dr. Antonio Péñafiel, Sociedad Cientifica "Antonio Alzate," Mexico.

Donation to Cabinet—Phototype of Dr. Benjamin Franklin, from Mr. Julius R. Sachse, Philadelphia, Pa.

Accessions to the Library were reported from the R. Geographical Society of Australasia (Queensland Branch), Brisbane; R. Geographical Society of South Australasia, Melbourne; Royal Society of New South Wales, Australasian Association for Advancement of Science, Sydney; Royal Society of Tasmania, Hobart; Tokyo Library, Geographical Society; Royal Asiatic Society (Straits Branch), Singapore; K. Akademie der Wissenschaften, Comité Geologique, St.

Petersburg; Société Finno-Ougrienne, Helsingfors; Société des Naturalistes, Kief; Société des Naturalistes, Odessa; Institut Météorologique de Roumaine, Bucarest; Naturforsche Gesellschaft, Dorpat; University, Lund, Sweden; K. Norske Videnskabers Selskab, Throndhjem; Naturforschender Verein, Brünn, Austria; K. K. Sternwarte, K. Böhmische Gesellschaft der Wissenschaften, Prag; K. Akademie der Wissenschaften, Geologische Reichsanstalt, K. K. Naturhistorische Hof-Museum, Vienna; Physiologische Gesellschaft, K. P. Geologische Landesanstalt und Bergakademie, Berlin; Naturwissenschaftlicher Verein, Bremen; Naturwissenschaftliche Gesellschaft (Isis), Dresden; Oberhessische Gesellschaft, Giessen; Naturhistorische Gesellschaft, Hanover; K. Gesellschaft der Wissenschaften, Göttingen; Gesellschaft zur Beförderung der Gesammten Naturwissenschaften, Marburg; Centralbureau der Internationalen Erdmessung, Potsdam; Altertumsverein für Zwickau und umgegend, Zwickau; Nederlandsche Maatschappij ter Bevorderung van Nijverheid, Musée Teyler, Hollandaise Maatschappij der Wetenschappen, Harlem; Friesch Genootschap van Geschied-Oudheiden Taalkunde, Leeuwarden; Maatschappij der Nederlandsche Letterkunde, Leiden; K. Bibliothek, 's Gravenhage; Société R. Malacologique de



cal and Literary Society, Leeds; Royal Society, Linnean Society, Meteorological Council, London; Literary and Philosophical Society, Manchester; Natural History Society of Northumberland, Durham, etc., Newcastle-on-Tyne; Royal Irish Academy, Dublin; Geological and Natural History Survey of Canada, Ottawa; Canadian Institute, Toronto; Novascotian Institute of Science, Halifax; Society of Natural Sciences, Portland; Agricultural Experiment Station, Amherst, Mass.; Massachusetts Historical Society, Mr. Robert T. Swan, Boston; Messrs. Hilborne T. Cresson, Andrew McFarland Davis, Cambridge, Mass.; Free Public Library, New Bedford, Mass.; Rhode Island State Agricultural Experiment Station, Providence; Connecticut Historical Society, Hartford; Yale University, American Oriental Society, New Haven, Conn.; Brooklyn Library; Prof. James Hall, Albany, N. Y.; Agricultural Experiment Station, Geneva, N. Y.; American Institute of Electrical Engineers, Academy of Sciences, Council of the Scientific Alliance of New York, American Museum Natural History, Meteorological Observatory, New York; New Jersey Agricultural Experiment Station, Geological Survey of New Jersey, Trenton; Pennsylvania Geological Survey, Harrisburg; State College, Pennsylvania; Zoölogical Society, Messrs. R. Meade Bache, Amos P. Brown, A. F. Chamberlain, John Ellis, Moses Klein, Henry Phillips, Jr., Philadelphia; Agricultural Experiment Station, College Park, Md.; Peabody Institute, Baltimore, Md.; Smithsonian Institution, Philosophical Society, Geological Survey, U. S. Naval Observatory, War Department, U. S. Board of Geographical Names, Bureau of Education, Director of the Mint, U. S. Fish Commission, Washington, D. C.; Col. C. C. Jones, Jr., Augusta, Ga.; Historical Society, Savannah, Ga.; Tulane University, New Orleans, La.; Archæological and Historical Society, Columbus, O.; Cincinnati Observatory; University of Chicago; University of Michigan, Ann Arbor; Public Library, St. Louis, Mo.; Geological Survey of Missouri, Jefferson City; Wisconsin Academy of Sciences, Agricultural Experiment Station, Madison; State University of Iowa, Iowa

City; Editor of "Kansas University Quarterly," Lawrence; Washburn College, Agricultural Experiment Station, Topeka, Kans.; Agricultural Experiment Station, Fargo, N. Dak.; Museo Michoacano, Morelia, Mexico; Bishop Crescencio Carrillo, Merida, Yucatan; Institut Egyptien, Cairo.

A paper by Prof. Daniel Kirkwood, entitled "On the Mutual Relations Between the Orbits of Certain Asteroids," was presented by the Secretary.

Pending nomination No. 1242 was read.

Deferred business was laid over.

And the Society was adjourned by the President.

Stated Meeting, September 16, 1892.

Present, 5 members.

President, Mr. FRALEY, in the Chair.

Correspondence was submitted as follows:

A letter from Mr. Harold Goodwin, Philadelphia, accepting membership.



Naturforschende Verein, Brünn, Austria (134, 135); Dr. Francis Pulzsky, Budapest (135); Naturhistorische Landes-Museum von Kärnten, Klagenfurt (136); Astronomische und Meteorologische Observatorium, Triest, Austria (125–130, 136); Section für Naturkunde des Ö. T. C. bei K. K. Naturhistorische Hofmuseum (136), Anthropologische Gesellschaft (136), Dr. Edward Suess (137, 138), Dr. Friedrich S. Krauss (Diploma), Vienna; Gesellschaft für Erdkunde, K. Geologische Landesanstalt und Bergakademie, Prof. F. Reuleaux, Berlin (137); Naturhistorischer Verein, Bonn (136); Schlesische Gesellschaft für Vaterländische Cultur, Breslau (136); Verein für Erdkunde, Dresden (138); Deutsche Seewarte, Hamburg (137); Naturhistorische Gesellschaft, Hanover (137); Vogtländische Alterthumsforschende Verein, Hohenleuben (137); Gesellschaft zur Beförderung der Gesammten Naturwissenschaften, Marburg (134); Verein für Erdkunde, Metz (137); K. P. Geodätische Institut, Potsdam (137); Verein für Vaterländische Naturkunde in Würtemberg, Stuttgart (135); Schweiz. Naturforschende Gesellschaft, Bern (137, 138); Prof. Carl Vogt, Geneva (137, 138); Société Vaudoise des Sciences Naturelles, Lausanne (137, 138); R. Accademia de Scienze, Lettere, etc., Padova (136); Marquis Antonio de Gregorio, Palermo (136); R. Osservatorio, Torino (136); Ministère des Travaux Publics, M. Victor Duruy, Profs. Emil Levasseur, E. Mascart, Paris (137); Mr. Samuel Timmins, Arley, Coventry, Eng. (Diploma and 138); Philosophical Society, Cambridge, Eng. (Trans., xvii, 1, 2, and 138); Royal Society (Trans., xvii, 1, 2, and 138); R. Meteorological Society, Royal Institution of G. B., R. Geographical Society, Victoria Institute, Mr. C. Juhlin Dannfeldt, Prof. William Crookes, Sirs Joseph D. Hooker, James Paget, Henry Thompson, London (138); Manchester Geographical Society (138); Natural History Society of Northumberland, Durham and New Castle-on-Tyne (138); Royal Society of Edinburgh (Trans., xvii, 1, 2, and 138); Royal Observatory, Edinburgh (138); Philosophical Society, Glasgow (138); R. I. State Agricultural Experiment Station, Kingston (137, 138); Prof. J. J. Stevenson, New York (138); Prof. W. Le Conte

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Stevens, Troy, N. Y. (138); Prof. E. D. Cope, Mr. H. H. Houston, Philadelphia (138); U. S. Geological Survey, Washington, D. C. (Trans., xvii, 1, 2, and 138); Leander McCormick Observatory, University of Virginia (138); "Journal of Comparative Neurology," Granville, O. (138); Dr. Robert Peter, Lexington, Ky. (138); Kansas Academy of Science (138), Washburn College (137), Topeka; Prof. Daniel Kirkwood, Riverside, Cal. (138); Bishop Crescencio Carrillo, Merida, Yucatan (138).

Accessions to the Library were announced from the Comité de Conservation des Monuments de l'Art Arabe, Cairo; New Zealand Institute, Wellington; K. K. Mineralogische Gesellschaft, St. Petersburg; K. Zoologisch. Botanische Genootschap, 's Gravenhage; Genootschap van Kunsten en Wetenschappen, Batavia; Académie des Sciences, Cracow; K. K. Militär Geographische Institut, K. K. Geologische Reichsanstalt, Vienna; K. Akademie der Wissenschaften, Physiologische Gesellschaft, Berlin; Naturhistorischer Verein, Bonn; Verein für die Geschichte und Altertumskunde, Erfurt; Oberlausitzer Gesellschaft der Wissenschaften, Görlitz; Vogtländische Alterthumsforschende Verein, Hohenleuben; Verein für Vaterländische Naturkunde, Stuttgart;



Prof. Joseph Lovering, Cambridge, Mass., born December 25, 1813; died January 18, 1892.

Pending nomination 1242 and new nominations 1243 and 1244 were read.

On motion, the Society

Resolved, That Dr. Charles E. Sajous be appointed a delegate to represent this Society at the Congrès des Américanistes, to be held at Huelva in October, 1892, provided that the same shall entail no expense upon this Society.

And the Society was adjourned by the President.

Stated Meeting, October 7, 1892.

Present, 16 members.

President, Mr. FRALEY, in the Chair.

Correspondence was submitted as follows:

A circular letter from Prof. Edward C. Pickering, Cambridge, Mass., in regard to a large southern telescope, and soliciting funds for same.

Accessions to the Library were reported from the Government Geologist, Adelaide, Australia; Académie Royale des Sciences, Amsterdam; "Flora Batava," Leiden; Mr. G. Bauer, Agram, Hungary; K. K. Naturhistorische Hofmuseum, Vienna; Mr. Albin Weisbach, Freiberg, Baden; Verein für Naturkunde, Offenbach a. M.; Société Languedocienne de Géographie, Montpellier; University Library, Cambridge, England; Radcliffe Observatory, Oxford; Natural History and Antiquarian Society, Penzance; Royal Dublin Society; Department of Agriculture, Ottawa, Canada; Agricultural Experiment Station, Bangor, Me.; Pope Manufacturing Co., Boston; Harvard University, Cambridge; Mr. Andrew McFarland Davis, Salem; American Antiquarian Society, Worcester; Dr. George Eastburn, American Meteorological Society,

Public Opinion Co., New York; Numismatic and Antiquarian Society, Mr. Henry Phillips, Jr., Philadelphia.

Letters of envoy were received from the Académie des Sciences, Amsterdam; Radcliffe Observatory, Oxford, England; Zoölogical Society, London; Royal Dublin Society; Geological and Natural History Survey, Department of Agriculture, Ottawa, Canada.

Letters of acknowledgment were received from the Royal Society of Victoria, Melbourne (136); Naturforsch. Gesellschaft, Dorpat, Russia (134); K. Danske Videnskabernes Selskab, Copenhagen (136); Académie Royale des Sciences, Amsterdam (135, 136); Académie des Sciences, Cracow, Austria (136); Prof. Peter Tunner, Leoben (137); K. K. Central Anstalt für Meteorologie (138); Dr. Aristides Brezina, Vienna (137); Naturforschende Gesellschaft des Osterlandes, Altenburg (138); K. Meteorologische Institut (137), K. Geologische Landesanstalt u. Bergakademie (138), Berlin; Oberhessische Gesellschaft für Naturkunde und Heilhunde, Giessen (137); Geographische Gesellschaft, Hannover (136); K. Sächsische Gesellschaft der Wissenschaften (136), K. Sternwarte, Profs. Otto Böttlingk, I. Victor Carus (137, 138), Leipzig; Verein für Erdkunde, Metz (136); Verein der Freunde der



1892, æt. 70, and Thomas Chase (Providence, R. I.), October 6, 1892, æt. 66, were announced.

Prof. Daniel G. Brinton presented a paper entitled "Further Notes on the Betoya Dialect from Unpublished Sources."

Prof. E. D. Cope presented a paper on "The Phylogeny of the Vertebrata."

Also a paper on "Some Points in the Kinetogenesis of the Limbs of Vertebrata."

Pending nominations Nos. 1242, 1243 and 1244 were read.

The following report was presented from the Michaux Committee, and the resolution appended was, on motion, adopted:

TO THE AMERICAN PHILOSOPHICAL SOCIETY:

The Michaux Committee respectfully reports, that at a meeting of the Committee, held on September 16, 1892, a letter was received from Dr. J. T. Rothrock, enclosing the following list of the time and subjects proposed for the Fourteenth Course of lectures given under the auspices of the American Philosophical Society:

WEDNESDAY EVENINGS.

Nov. 9. Trees of Pennsylvania (illustrated).
" 16. History and Fertility of Soil (illustrated).
" 23. What is Economic Botany?
" 30. Plant Form Applied to Decorative Art (illustrated).
Dec. 7. Plant Structure Applied to Mechanical Art (illustrated).
" 14. How to Plant and Grow Trees.
" 21. How to Care for Trees.

It is expected that the lectures will be delivered in the Hall of the Academy of Natural Sciences, which has been kindly tendered to him by the Academy for that purpose.

The Committee approved of the proposition and requests the Society to make an appropriation of $244 out of the income of the Michaux Fund to meet the expenses of the lectures.

The Committee submits the following resolution, which it desires shall be passed by the Society:

"*Resolved*, That the sum of two hundred and forty-four dollars be appropriated out of the income of the Michaux Fund towards the expenses of the Fourteenth Course of the Michaux Forestry Lectures by Dr. J. T. Rothrock."

By order of the Committee,

J. SERGEANT PRICE, *Secretary*.

The following letter was read and the Curators were requested to report to the Society upon the request it contained:

PHILADELPHIA, May 20, 1893.

FREDERICK FRALEY, ESQ.,

President of the American Philosophical Society:

Dear Sir:—The Joint Special Committee appointed by the Councils of Philadelphia to secure a proper representation of historical and other exhibits from Philadelphia at the World's Columbian Exposition, to be held at Chicago, propose taking the Liberty Bell and other objects in possession of the city, and are desirous of securing additional relics. An inspection of the contents of the Hall of your Society convinced the Committee that an exhibition of the following objects in your possession would greatly add to the interest of Philadelphia's display, viz.:

1. Chair in which Thomas Jefferson wrote the Declaration of Independence.
2. Chair owned and used by Benjamin Franklin.
3. Electrical device invented by Franklin.
4. Chair of Joseph Bonaparte from his residence at Bordentown.
5. Polygraph used by Jefferson.
6. Unsigned copy of the Declaration of Independence made by Jefferson, with interlineations.

And other relics of historical and antiquarian interest.

Proper attention will be given to the care and preservation of all articles exhibited under the custodianship of the Committee.

I therefore earnestly request that your Society will take into consideration the proposition to permit the above-named articles to be exhibited at



OCTOBER 21, 1892, having been designated by the President of the United States and by the Governor of the State of Pennsylvania as a public holiday, no meeting of the American Philosophical Society was held on that evening.

Stated Meeting, November 4, 1892.

Present 14 members.

Vice-President, DR. RUSCHENBERGER, in the Chair.

Correspondence was submitted as follows:

An invitation from the Naturforschende Gesellschaft des Osterlandes, Altenburg, to be present at its seventy-fifth anniversary, October 8 and 9, 1892.

A circular from the University of Padua, announcing the commemoration of the four hundredth anniversary of the connection of Galilæo Galilæi with the University.

Letters of envoy were received from the Geological Survey of India, Calcutta; K. P. Meteorologisches Institut, K. Geologische Landesanstalt und Bergakademie, Editors of "Lateinische Litteraturdenkmäler," Berlin; Schlesische Gesellschaft für Vaterländische Cultur, Breslau; Department of the Interior, Washington D. C.; Direccion Général de Estadistica, Mexico.

Letters of acknowledgment were received from the Geological Survey of India, Calcutta (137); Dr. Otto Donner, Helsingfors, Finland (136–138); Société Imp. Mineralogique (137); Russian Chemical Society (137, 138); Central Physical Observatory (138); Imperial Academy of Sciences, St. Petersburg (138, and Trans., xvi, 1 and 2); R. Norwegian Society of Science, Throndhjem (137, 138); Société R. de Geographie, Antwerp, Belgium (125–130, 136–138); Société Hongroise de Geographie, Budapest (137, 138); Academy of Science, Cracow, Austria (137); Naturhistorisches Landesmuseum von

Karten, Klagenfurt, Austria (137); Dr. Hermann Rollett, Baden bei Wien (136, 137); Drs. Friederich S. Krauss, M. Much, Vienna (137, 138); Anthropologische Gesellschaft, Redaction der "Naturwissenschaftlichen Wochenschrift," Berlin (138); K. Meteorologische Institut, Chemnitz (138); Naturwissenschaftliche Gesellschaft "Isis," Dresden (137, 138); Vogtländische Altertumsforschende Verein, Hohenleuben (138); Verein der Freunde der Naturgeschichte, Mecklenburg (138); Geodätisches Institut, Potsdam (138); Würtembergische Verein für Handels-Geographie, Stuttgart (137); R. Instituto Lombardo di Scienze e Lettere, Milan (137); Societa Africana d'Italia, Naples (137); Marquis Antonio Di Gregorio, Palermo (137); Prof. G. Sergi, Rome (137); R. Osservatorio, Turin (137); Marquis de Nadaillac, Prof. E. Mascart, Paris (138); Prof. J. P. Postgate, Cambridge, Eng. (137, 138); Dr. Friederich Müller, Oxford, Eng. (137); Prof. James Geikie, Edinburgh (138); Dr. J. McK. Cattell, New York (138); Oneida Historical Society, Utica (137, 138); Mr. Cadwalader Biddle, Admiral E. Y. Macauley, Philadelphia (138); Smithsonian Institution (Trans., xvi, 1 and 2, and 132–136); Academy of Sciences, Chicago (137).

Accessions to the Library were reported from the Imperial Geographical Society, St. Petersburg; Société R. des Anti-



Messrs. Thomas H. Dudley, William John Potts, Camden; Bureau of Statistics of New Jersey, Trenton; Academy of Natural Sciences, Editors of the "Medical and Surgical Reporter," Messrs. MacCalla & Co., Levytype Co., Messrs. John F. Lewis, Henry Phillips, Jr., Philadelphia; National Academy of Sciences, Smithsonian Institution, Census Office, War Department, Washington, D. C.; Colorado Scientific Society, Denver; Direccion Général de Estadistica, Mexico.

The decease of the following members was announced:

Dr. Pliny Earle, Northampton, Mass., May 17, 1892, æt. 83.

Sir Daniel Wilson, Toronto, August, 1892, æt. 77.

James B. Francis, Lowell, Mass., September 17, 1892, æt. 78.

Dr. Brinton read a paper "On the Etrusco-Libyan Elements in the Song of the Arval Brethren."

Pending nominations Nos. 1242, 1243 and 1244, and new nomination No. 1245 were read.

The Committee on Publication reported in favor of the publication of Dr. Hilprecht's Assyrian Transcripts, which was agreed to and publication ordered in the Transactions.

Dr. Morris, on behalf of the Curators, presented a report on the portrait owned by the Society labeled Francis Hopkinson, stating that in their belief it was that of Samuel Vaughan.

Mr. Fraley gave what in his opinion were the facts of the case. On motion of Mr. Fraley, the Society resolved to place the name of Samuel Vaughan on the portrait referred to.

And the Society was adjourned by the presiding member.

Stated Meeting, November 18, 1892.

Present, 11 members.

Mr. THOMAS H. DUDLEY in the Chair.

Correspondence was submitted as follows:

An invitation from the Historical Society, Chicago, to be

present at the laying of the cornerstone of their new building, November 12, 1892.

New exchanges ordered: Naturforscher-Gesellschaft, Dorpat, Russia; Université Laval, Quebec, Canada; Société d'Historie et d'Archæologie de Chalon-sur-Saone, Montbéliard, France.

Letters of acknowledgment were received from the Société Imperiale Mineralogique (138, and Trans., xvii, 1, 2); Comité Géologique de la Russe (137, 138); Prof. Serge Nikitin, St. Petersburg (136, 137, 138); Musée R. d'Histoire Naturelle de Belgique, Bruxelles (135–138); K. Universitetet, Lund, Sweden (137); K. Bibliothek (137); Gesellschaft für Erdkunde, Berlin (138); Naturwissenschaftlicher Verein, Bremen (138); K. Sächsischer Altertumsverein, Dresden (137); Senckenbergische Naturforschende Gesellschaft, Frankfurt a. M. (135); Prof. E. Hæckel, Jena (136, 137); Naturwissenschaftlicher Verein, Kiel (135–137); Societa Africana d'Italia, Naples (138); R. Biblioteca Universitaria, Pisa (137); R. Accademia dei Lincei (138); Prof. G. Sergi, Rome (138); Société d'Borda, Dax (137); Société des Sciences Naturelles et Archéologiques de la Creuse, Guéret (137); Société des Antiquaires de la Morinie, St. Omer (137); Geological Society, London (137);



Philologique, Musée Guimet, Paris; Société des Antiquaires de la Morinie, St. Omer; Editors of the "Yale Review," Boston; Royal Society of Canada, Montreal; Dr. Daniel G. Brinton, Mr. Henry Phillips, Jr., Philadelphia; Miss R. C. Longstreth, Sharon Hill; Hydrographic Office, Department of the Interior, Washington, D. C.

Photographs of Dr. John J. Stevenson, New York, and Mr. M. Fisher Longstreth, Sharon Hill, Pa., were received for the Album.

Dr. W. P. Wilson presented for the Transactions a paper by James Ellis Humphrey on "The Saproleginaceæ of the United States, with Notes on Other Species." On motion the paper was referred to a Committee of three members of the Society, to be appointed by the President at his leisure.*

The Secretaries presented a "Kwakiutl Vocabulary," by Dr. Franz Boaz (of Worcester, Mass.).

Mr. Lorin Blodgett exhibited a cosmical map of the Northern Hemisphere, and made some remarks thereon.

Dr. Cope read a paper on "A False Elbow in a Horse."

Pending nominations Nos. 1242, 1243, 1244, and new nominations Nos. 1245, 1246, 1247 and 1248 were read.

Dr. Morris as Curator placed before the Society some of the interesting articles found by him in the museum, such as the theodolite belonging to the Proprietor's family, used in laying out the lots of Philadelphia, and on Mason and Dixon's line, presented by Dr. Physick; the model of a mowing machine presented in 1771; of a fire-escape, by Rev. Dr. Collin, in 1791; of a bathometer deposited by Jefferson in 1806; of a torpedo-boat, by Fulton, in 1815, etc.

Dr. Morris suggested the following heads as useful for classifying the cabinets, at least temporarily, viz.:

Objects illustrating American antiquities, such as the Peale collection, the Poinsett collection, and many Indian relics.

Objects illustrating progress of science and art, and the history of thought in other countries.

* The President subsequently appointed as said Committee, Dr. Rothrock and Messrs. Meehan and Martindale.

Objects illustrating mechanical arts and appliances, for agriculture, commerce, navigation, etc.

Geological, mineralogical and botanical specimens—in the latter class are many of great value, including Muhlenberg's Herbarium.

Scientific instruments, and instruments of precision—some of them rare and possessing great historical value.

Miscellaneous objects of interest to the student of the progress of human thought and civilization.

On motion the Curators were authorized to have framed for display a series of plaster medallions.

And the Society was adjourned by the presiding member.

Stated Meeting, December 2, 1892.

Present, 13 members.

President, Mr. FRALEY, in the Chair.

Correspondence was submitted as follows:

Letters of envoy were received from the K. Sächsische Gesellschaft der Wissenschaften, Leipzig; Zoölogical Society



l' Histoire de France, Marquis de Nadaillac, Prof. Paul Topinard, Paris; Victoria Institute, London; University of the State of New York, Albany; Mr. Mark V. Slingerland, Ithaca; Mr. Henry Phillips, Jr., Philadelphia; Bureau of Education, Prof. Cleveland Abbe, Washington, D. C.; Observatorio Astronómico Nacional de Tacubaya, Mexico; Société Scientifique du Chili, Santiago.

The Committee on Dr. J. E. Humphrey's paper was continued.

The report of the Treasurer was read and referred to the Finance Committee.

The report of the Publication Committee for the year was made.

The report of the Library Committee was approved.

On motion, Prof. Cope was permitted to withdraw the paper presented by him at the last meeting, and to substitute therefor one on "False Elbow Joints."

Pending nominations Nos. 1142 to 1248, and new nominations Nos. 1249 and 1250 were read.

And the Society was adjourned by the President.

Stated Meeting, December 16, 1892.

Present, 18 members.

President, Mr. FRALEY, in the Chair.

Correspondence was submitted as follows:

A letter from the K. K. Geographische Gesellschaft, Vienna, discontinuing exchanges with the Society, as it has determined in future only to exchange with Geographical Societies.

A circular from the Comité G. A. Hirn, Colmar, Alsace, soliciting subscriptions for the completion of the monument to be erected to Prof. G. A. Hirn.

A letter from Mr. Harold Goodwin, Philadelphia, a new member, apologizing for not having previously taken his seat.

Letters of envoy were received from Mr. Henry Carey Baird, Philadelphia; Library of Oberlin College, Oberlin, O.; Texas Academy of Science, Austin.

Letters of acknowledgment were received from the Institut Egyptien, Cairo (136, 137); Prof. Francis Pulzsky, Budapest, Hungary (134, 136–138); University of Bonn (138); Naturforschende Gesellschaft, Freiburg i. B. (138); Dr. Albin Weisbach, Freiberg, Saxony (137); Prof. Dr. Doëderbeen, Strassburg, Alsace (135–138); I. R. Accademia Degli Agiate Rovereto, Tyrol (137); Société Geologique de France, Paris (137, 138).

Accessions to the Library were reported from the Physikalisch-Œkonomische Gesellschaft, Königsberg; Nassauische Verein für Naturkunde, Weisbaden; Societá Africana D'Italia, Naples; Naturforschende Gesellschaft, Zurich; Instituto y Observatorio de Marina, San Fernando; Royal Astronomical Society, London; Hon. R. C. Winthrop, Astronomical Observatory of Harvard College, Cambridge, Mass.; Geological Society of America, Rochester, N. Y.; Dr. Charles A. Oliver, Messrs. Abraham Jordan, Henry Phillips, Philadelphia; U. S. Coast and Geodetic Survey, Bureau of Education, Washington, D. C.; Oberlin College; Texas Academy of Science, Austin; Free Public Library, San Francisco, Cal.

The Committee upon Dr. Humphrey's paper for the Transactions reported it worthy of publication, which was so ordered and the Committee discharged.

This being the regular evening for the election of members, pending nominations Nos. 1242 to 1248 were read, spoken to and balloted for.

New nominations Nos. 1249, 1250 and 1251 were read.

The death of Dr. John S. Newberry, December 7, 1892, æt. 70, was reported.

The report of the Finance Committee was presented and the appropriations for the ensuing year were passed.

The Curators presented the following report:

CURATORS' REPORT UPON THE SOCIETY'S RESOLUTION OF MAY.

1. The Curators respectfully state that the cataloging and labeling of the Poinsett and Keating collection beyond that which has been already done is impracticable under present conditions. And we would suggest that such a proposition as that involved in the Society's resolution is a matter demanding the consideration and personal supervision of a specialist in American archæology.

2. Before it is possible to determine where the collection will best serve the purposes of ethnological study, the Curators believe that this Society should have an official declaration from the Academy of Natural Sciences: First, as to its desire to retain it. Secondly, as to the manner of display which the Academy would guarantee for it, and any conditions which the Academy would propose to put upon the retention of the aforesaid collection as a loan from this Society.

PATTERSON DU BOIS, *Chairman.*
J. CHESTON MORRIS,
(as to Section 1 only.)
R. MEADE BACHE.

Dr. Morris from the Curators presented a minority report as to the second section of their communication as follows, viz.:

Whereas, The Museum of the Society is now in a fireproof building, and has space where the Keating and Poinsett collections can be well displayed for purposes of study, and the reasons for its deposit in the care of the Academy of Natural Sciences no longer exist; therefore, be it

Resolved, That the Academy of Natural Sciences be requested to return these collections in accordance with the terms of deposit.

J. CHESTON MORRIS, M.D.,
one of the Curators.

Dr. Morris moved that the Academy of Natural Sciences be requested to return the said Poinsett, etc., collection.

Mr. Williams moved, as an amendment, that the majority report be adopted.

After a discussion the amendment was adopted and the majority report was agreed to.

The request of Dr. Elliott Coues for the withdrawal of the Lewis and Clark Note-books, accompanied by proper vouchers, was read.

Dr. Morris moved that the subject be referred to the Library Committee with power to act.

Mr. Price offered the following substitute, which was accepted by Dr. Morris and adopted by the Society.

Dr. Coues, a member of the Society from Washington, having presented a request to the Society that the Lewis and Clark papers deposited with the Society, on April 8, 1818, under a receipt of that date be loaned to him for the purpose of preparing a new edition of the travels of those gentlemen, it was on motion of Mr. Price:

Resolved, That the Librarian be authorized to lend to Dr. Coues all the papers now in our possession deposited by Lewis and Clark in the year 1818, as per said receipt, he taking from the doctor his obligation (with a sufficient penalty) to take care of them, keep them when not in his library in some safe deposit vault at Washington, and return them at the expiration of three months unless further time shall be given to him to retain them.

Mr. Williams offered the following resolution, which after discussion was adopted:

Resolved, That the Curators of the Society be requested to report upon the cost of placing the Poinsett and Keating collection in this Museum and caring for it, and upon other collections or institutions in this city, if any, with which this collection could be deposited with advantage to the cause of science and the study of this collection, and upon some plan for arranging the collections of the Society in its Museum in accordance with the wishes, if any, of the donors of different collections.

The result of the balloting for members was reported to the President, who declared the following named to have been duly elected members of the Society.

2205. Mr. Charles H. Cramp, Philadelphia.
2206. Prof. Samuel G. Dixon, M.D., Philadelphia.
2207. Prof. John M. Macfarlane, D. Sc., Lansdowne, Phila.
2208. Prof. Francis X. Dercum, M.D., Philadelphia.
2209. Prof. James Ellis Humphrey, D. Sc., Amherst, Mass.

And the Society was adjourned by the President.

The Etrusco-Libyan Elements in the Song of the Arval Brethren.

By D. G. Brinton, M.D., LL.D.

(*Read before the American Philosophical Society, November 4, 1892.*)

In two communications to the American Philosophical Society, published respectively in 1889 and 1890, I offered a series of considerations which led me to believe that there existed an affinity, or ethnic relationship, between the ancient Etruscans and the Libyans, or Berber tribes, of North Africa.* In the present paper I would supplement what I there said by a brief study of the Etrusco-Libyan elements in one of the oldest literary monuments of Roman antiquity—the Song of the Arval Brethren.

These *Fratres Arvales* were a priestly sodality, which, according to tradition, dated back to the foundation of Rome, Romulus himself having been one of the twelve members of which the sacred college was composed. Their function was to perform certain acts of worship at a festival in the month of May in honor of "the divine goddess" *Dea Dia*, whose proper name is nowhere mentioned. The object of the festival was propitiatory to the divinities of agriculture, that the fields might yield bounteous harvests; whence the brotherhood derived its name—*ut ferunt fruges arva.* The rites consisted of sacrifices, processions, and, at a certain stage of the proceedings, of the repetition of a very ancient song, the words of which, as being too archaic for the members, were in the time of the Empire written down in small books, which the Brethren held in their hands as they chanted.

Although classical authors scarcely mention the Arval Brethren, we have very minute accounts of their rites, for it was their laudable custom at the close of each annual festival to inscribe the fact of the celebration with its date and some other particulars on a slab of stone. Nearly one hundred of these memorials have been discovered from time to time, and on one of the tablets, exhumed in 1778, recording the annual festival in May, A.D. 218, the Brethren had the happy idea to cause the song itself to be inscribed. They apparently gave the "copy" to the local stonecutter, and did not stay to read the proof, for he has made several palpable blunders, such as spelling the same word differently in different

* "The Ethnologic Affinities of the Ancient Etruscans," *Proc. Amer. Phil. Soc.*, Vol. xxvi; "On Etruscan and Libyan Names," *Ibid.*, Vol. xxviii.

lines; but, as each line is repeated three times, we have a strong check on his vagaries. All critics agree, however, as to its value as a monument of antiquity, and one of its most recent editors does not go too far when he calls it "by far the most venerable specimen of Latin which we possess."*

Its interpretation has tasked the ingenuity of the learned; but, before I proceed to that, I will recall some facts about the origin of this priestly sodality. It was distinctly and wholly Etruscan, and was traditionally connected with the woman, Acca Larentia, and her Etruscan husband, Tarrutius. There are many stories told about Acca, and there are, according to some, a false and a true Acca; but those well acquainted with the kaleidoscope of mythology will find no difficulty in reconciling the beautiful and notorious Acca who was chosen, along with a plenteous board and a skin of old wine, to make merry the night with Hercules; the lascivious Acca, whom shepherds called *Lupa*, for she was as "salt as wolves in pride;" with the Acca who ruled the Lares, guardian spirits of the virtuous household, as her by-name *Larentia* indicates. As for her forename, *Acca*, *Αχca*, it occurs in Etruscan inscriptions, though its form has been doubted by some good scholars.

The story—or one of the stories, and the most consistent—ran that Hercules, after his joyous rendezvous, gave her the extremely sane and modern advice to marry the first rich man she could capture. This proved to be the worthy Tarrutius, by whom she



of the Dea Dia. There they spent three days—a charming escapade, no doubt, from city life—slaughtering a white heifer, also some specially fed young pigs, *porcilias piaculares*, and not forgotten by neighboring farmers with delicate spring vegetables, as we may gather from the records. Then came the antique song and solemn dance in the temple of the Goddess, the Brethren clad in quaint traditional garb, and crowned with wreaths of leaves and early wheat.

We may well suppose that with this history and these customs we should look among the Arval Brethren for true folklore, for the preservation of some of the ancient names and ideas of the Etruscan religion, in a day when they had quite passed out of the ken of the current worship and mythology of Rome. The place to look for it, of course, is in their Song, and I think we find it there with a plainness that cannot be mistaken, and yet which none of the commentators and critics has heretofore brought out, or even referred to.

The accurate text of that Song is subjoined. In giving it, I choose, in cases of discrepancy, where the majority of the sculptor's readings—that is, two out of three—are the same.

THE SONG.

ENOS LASES IVVATE
ENOS LASES IVVATE
ENOS LASES IVVATE

NEVE LVERVE MARMAR SINS INCVRRERE IN PLEORES
NEVE LVERVE MARMAR SINS INCVRRERE IN PLEORES
NEVE LVERVE MARMAR SINS INCVRRERE IN PLEORES

SATVR FVFERE MARS LIMEN SALI STA BERBER
SATVR FVFERE MARS LIMEN SALI STA BERBER
SATVR FVFERE MARS LIMEN SALI STA BERBER

SEMVNIS ALTERNEI ADVOCAPIT CONCTOS
SEMVNIS ALTERNEI ADVOCAPIT CONCTOS
SEMVNIS ALTERNEI ADVOCAPIT CONCTOS

ENOS MARMOR IVVATO
ENOS MARMOR IVVATO
ENOS MARMOR IVVATO

TRIVMPE TRIVMPE TRIVMPE TRIVMPE TRIVMPE

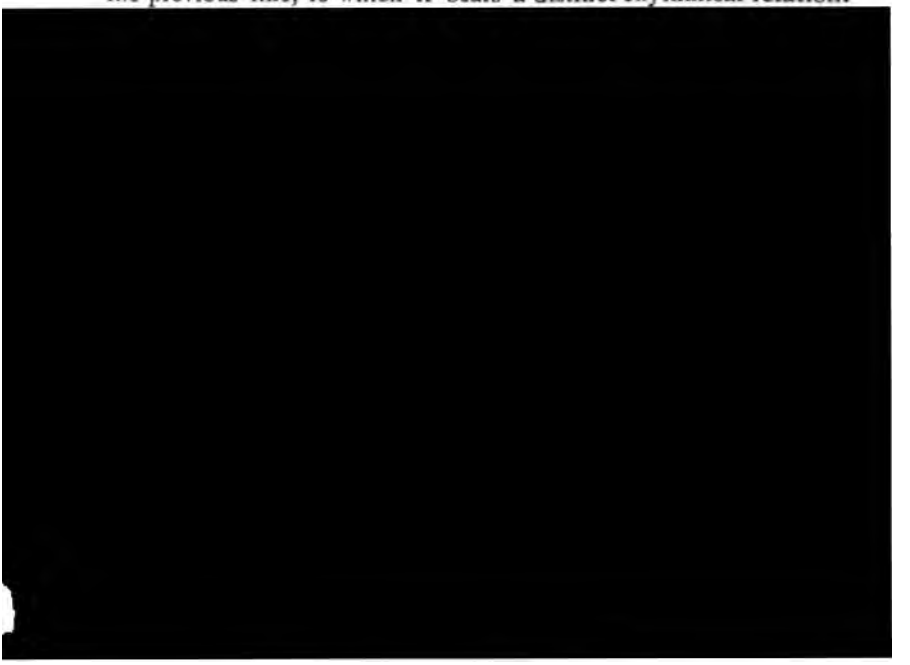
The translation of the first line offers no particular difficulty, as the initial *E* is prothetic and strengthening, and there are plenty of examples where *s* is preserved between two vowels for later *r*. Nor about line second is their serious controversy. The compound *iverve* may fairly be *luem ruem* (*ruinam*), and we may render:

> "Help us, O Lares;
> And, O Marmar, let not blight nor ruin fall upon the flowers."

Or, perhaps, instead of *pleores* = *flores*, we may take it *pleores* = *plures*, and translate "upon the multitude," though this has less pertinence.

But the third line is where the commentators have broken down. The latest authority within my reach, Prof. Allen, of Yale College, gives it up as hopeless, and leaves it untranslated. Mommsen proposes that it shall be split in two, one half an appeal to the gods, *Satur esto, fere mars!* "Be satiate, fierce Mars," and the other half to the individual brethren, *In limen insili! Sta! Verbera* (limen)!

This is terribly strained. Mars was not a fierce deity, nor god of war to the Etruscan, but of peace, of agriculture, and of the springtime. He was guardian of the husbandman, not of the warrior. The word *Berber* is repeated three times, without any variation, and is plainly a reduplicated proper name, like *Marmar* in the previous line, to which it bears a distinct rhythmical relation.



with Lases, Marmar and Mars, it is a more or less Latinized form of a pure Etruscan word, what could we make of it?

The first difficulty is that the Etruscan probably had no *b*, in which they resembled many of the modern Berber dialects, where it is also lacking. There was some intermediate labial in Etruscan which the Romans rendered by either *f*, or *v*, or *b*. Probably it was close to the Greek digamma, *F*. Did the Etruscans have a god *Fer*, or *Ver*? Undoubtedly. That was the exact name of the deity whom Varro calls *Deus Etruriæ princeps*, "chief of all the gods of Etruria." The Latin writers give his full name as Vertumnus; but that the last two syllables do not belong to the name, but constitute an appellative suffix, the analogy of the Etruscan words *Vol-tumna*, *Luχumna*, and many others, has long since convinced Etruscologists.*

The functions of this god *Fer* were most appropriate to the rites of the Arval Brethren. The gardens of the spring, the harvests of the summer, but especially the maturing grain and fruit of the autumn, were his special care. Thus he came to be a chief god, one who looked after home life and works. He was the culture-hero of the Etruscans, analogous to such figures as Michabo and Viracocha in native American mythology.

But here a striking identity meets us. Among the Libyans of Northern Africa this same divinity, with the same attributes and the same name, appears to meet us. Their chief god was also *Ber* (*Fer*, *Ver*); he was their protector and mythical ancestor; from him they claimed their name, *Berbers*, *Brebres*, etc.; and to this day the secluded tribes of the Sahara point to sacred spots where their famed progenitor and teacher was buried.†

It would be an easy error to suppose that *Ver* was the Latin word for spring from the Greek, and that in the Pantheon *Ver* was the personation of the season of spring; but this was not the case. The *Vertumnalia* were in the fall of the year, in the month of October, and were never supposed to have reference to any such

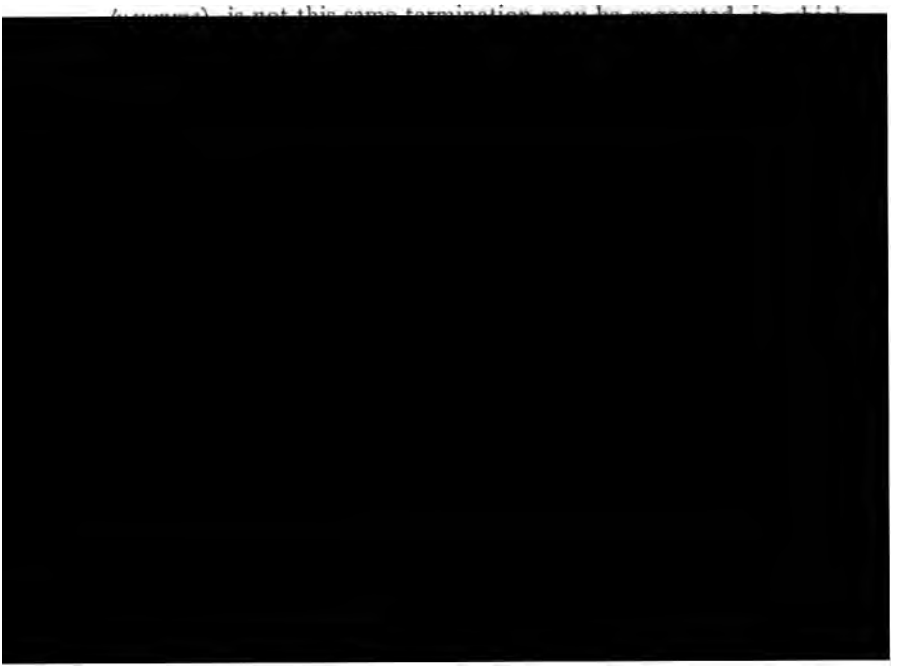
* See Deecke, note to Müller, *Die Etrusker*, Bd. ii, s. 51 *et al.* In some of the Latin geographers the name Berenice, that of a Libyan city, is spelled Verenice (Borsari, *Geografia della Tripolitana*, p. 191).

† "L'ancêtre commun de toutes les tribes berbères," Duveyrier, *Les Touaregs du Nord*. He is the *Iarbas* of Greek legend, son of Jupiter Ammon and a Libyan nymph, and king of the Getuli, to escape whose pressing solicitations Queen Dido plunged the sword into her own bosom. His immediate descendants are still referred to by the Touaregs as the *Iabbaren*.

impersonation. This fact brings out the antithesis in the line between the two divinities named. Marmar was the god of the early season and of the spring crops, Berber or Ver of the autumn and the late crops, and this was the reason for bringing them together in this adjuration for the fertility of the fields.

The meaning of Ber in the ancient Libyan language I have partly discussed elsewhere. It is from the biliteral root B R, the primitive meaning of which was "to overflow," or something equivalent to that idea. Applied to population, it was "to migrate," "to journey forth," and, as only freemen could have that privilege, it came to mean "to be free," and it was apparently in that proud significance in which it was adopted a patronymic. In its earlier sense it was and is applied to water which boils over, and in a neuter form it signifies "to be in excess," "to be abundant," and hence "to abound in," "to be fruitful in" (*foissoner*). Here we see where the meaning of *Ver* comes in, as the god of the harvest, of the fruitage and the vintage.

In the ancient Numidian epigraphy we find this name repeatedly inscribed on tombstones, usually with a similar suffix, *Vermim*, *Vermimo*, *Vermima*,* in which we easily see the biliteral Berber radical M M, from which are derived the terms for both mother *Imma*, and son *Emmi*. Whether the termination *-umnus*, so common in Etruscan names, and occasionally written *ummus* (*lucumno*,



of the line is given, "Call ye, in turns, on all the Semones." I should prefer to consider that *semones* refers distinctively to the two gods named *Marmar* and *Berber*, and that *advocapit* is an abbreviated form of the passive future, used impersonally, while *conctos* should have its original meaning, not "all," but "conjoined," "united," referring solely to the two divinities who are appealed to in the Song. It should then be rendered, "To these united gods of the crops (*i. e.*, the one of the early, the other of the later, season) praise shall be rendered."

The last lines offer no particular difficulties, so I offer this free paraphrase of the whole Song:

THE SONG OF THE ARVAL BRETHREN.

Come to our aid, O Lares!
O Marmar! Let nor blight nor ruin fall upon the flowers.
The sown seeds, O Marmar! protect; and favor the product, O Berber!
Praise shall be paid in turn to these associated gods of the crops.
Come to our aid, O Marmar!
Shout for joy! shout for joy! shout for joy!

The similarities which I here point out have an additional interest in the light of some recent discoveries in Egyptian archæology.

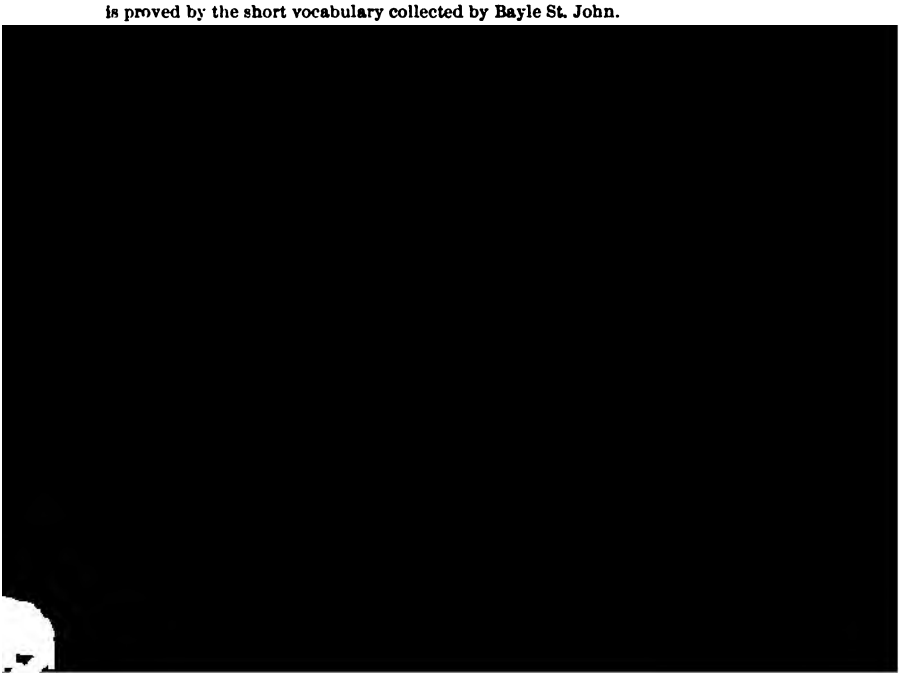
It has been generally accepted that the Tur-sha, who, about the close of the thirteenth century B.C., invaded Egypt from the West along with the Libyans, were Etruscans; but only recently has it been shown by conclusive evidence that the Etruscans continued to live in the Western Fayoom and on the Libyan boundary of Egypt for many centuries afterwards. One part of this evidence is from Egyptian inscriptions. At Medinet Gurob, close to the Libyan boundary, Mr. Flinders Petrie exhumed the coffin of a man bearing the inscription *An-en-Tur-sha*, "A man of the Tur-sha," showing that prominent citizens of Egypt (the coffin was that of a wealthy person) were at that time recognized as of the *Tur-sha* blood.

Still more extraordinary was the discovery of an Etruscan Ritual Book in this portion of Egypt, the celebrated Agram Codex, which has lately been published by Prof. Krall, of Vienna. He considers it conclusive as to the existence of an Etruscan settlement in this part of the Egyptian dominions.*

* *Die Etruskischen Mumienbinden des Agramer National-Museums*, ss. 18, 19 (Wien, 1892). He quotes and discusses Petrie's researches at Medinet Gurob.

Such facts lead us to inquire particularly as to what we know from the oldest authors concerning the population of the territory immediately west of lower Egypt. On turning to the best and oldest authority, Herodotus, who obtained his information from members of the Greek colony at Cyrene, I was surprised to find that he locates precisely in the region referred to a tribe whose name, as he gives it, is evidently that of the Tur-sha—to wit, the *Adur-machides*.* It is possible that *machides* is a Cyrenaic Greek termination, meaning "warriors;" at any rate we have the stem *Adur* or *Atur*, which is precisely what recurs in *Etruria*. It is undoubtedly a Libyan word, from the root D R or D R'R, whence the words for mountain, *adar* or *adrar*. The *Tur-sha* were, therefore, the mountaineers, those dwelling in the range of mountains which rise to form the eastern Libyan plateau. The analogy between *adar* and *adrar* on the one hand, and *adur* and *etrur*, on the other, is very noticeable. As the Italian Etruscans made little use of the letter *d*, substituting for it the *t*, we have the very common Tuscan radical *tur* or *tar*, as in the name of the field which the mother of the Arval Brethren on dying left to Romulus, the *ager turax* or *tarux*.†

* He assigns their position as "from the borders of Egypt to Port Plynus," and distinguishes them from the Ammonii of the Oasis of Jupiter Ammon, the modern El Giwah (*Hist.*, Book iv, cap. 168). The latter to this day speak a well-marked Berber dialect, as is proved by the short vocabulary collected by Bayle St. John.



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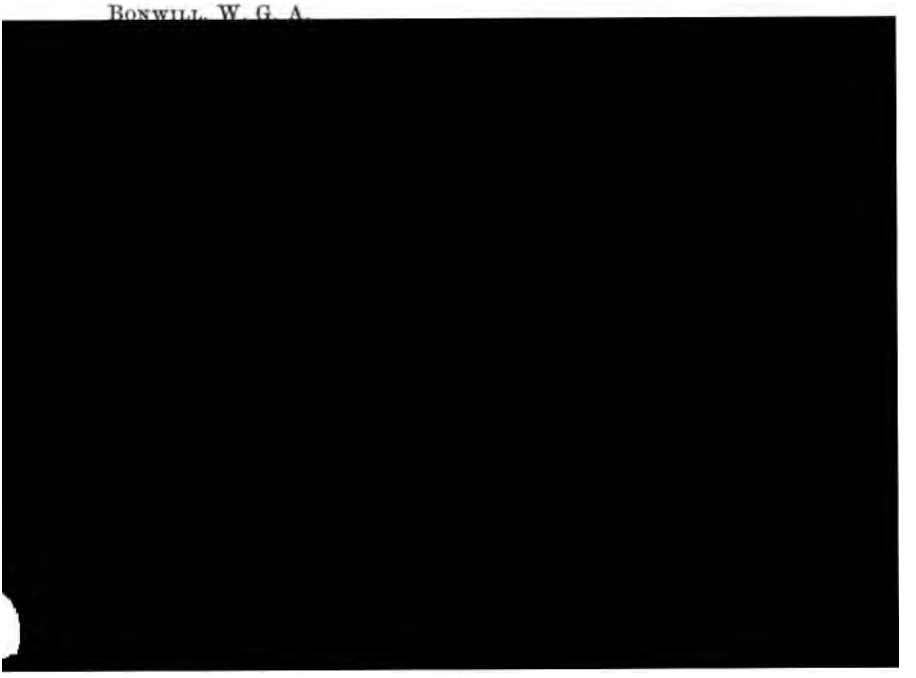
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List of surviving Members of the American Philosophical Society, held at Philadelphia for Promoting Useful Knowledge.

The addresses here given so far as known are at the present time. Corrections of this list are respectfully solicited.

A name printed in *italics* indicates that the Society is uncertain as to whether such member is still living and desires information on the subject.

The Society will be happy to receive *photographs* (cabinet size preferred) of such of its members as have not already sent.

A

	Name.	*Date of Election.*	*Present Address.*
1687.	ABBÉ, CLEVELAND.	July 21, 1871,	Army Weather Bureau, Washington, D. C.
2170.	ABBOTT, CHARLES C.	Dec. 20, 1889,	Bristol, Pa.
1463.	ABBOT, HENRY L.	April 18, 1862,	New York city, N. Y.
1809.	ÅCKERMAN, RICHARD	July 21, 1876,	Stockholm, Sweden.
1713.	ACLAND, HENRY W.	Jan'y 17, 1873,	Oxford, England.
2128.	ADAM, LUCIEN.	Dec. 17, 1886,	Rennes, France.
2081.	ADAMS, H. B.	May 21, 1886,	Baltimore, Md.
1381.	*Adamson, Rev. John C.*	July 13, 1856.	
1779.	AGASSIZ, ALEXANDER	April 16, 1875,	Cambridge, Mass.
1642.	AGASSIZ, ELIZABETH.	Oct. 15, 1869,	" "
2091.	ALBRECHT, PAUL.	May 21, 1886,	Hamburg, Germany.
1860.	ALISON, ROBERT H.	May 3, 1878,	Ardmore, Pa.
1869.	ALLEN, JOEL ASAPH	Sept. 20, 1878,	New York, N. Y.
1776.	ALLISON, JOSEPH.	April 16, 1875,	Philadelphia.
1927.	AMES, CHARLES G.	Jan'y 21, 1881,	Boston, Mass.
2064.	ANDERSON, GEORGE B.	Feb'y 19, 1886,	West Point, N. Y.
1655.	ANDERSON, GEORGE W.	Oct. 15, 1869,	Rosemont, Pa.
2164.	ANGELL, JAMES B.	Oct. 18, 1889,	Ann Arbor, Mich
1122.	*Angelis, Pedro de.*	Jan'y 17, 1840,	*Buenos Ayres, S. A.*
2102.	ARGYLL, DUKE OF.	May 21, 1886,	London, England
1761.	ARMSTRONG, WM. GEORGE	July 17, 1874,	Newcastle-on-Tyne, England.
1996.	ASHHURST, JOHN.	Jan'y 18, 1884,	Philadelphia.
2012.	ASHHURST, RICHARD L.	April 18, 1884,	"

B

	Name.	*Date of Election.*	*Present Address.*
1995.	BACHE, R. MEADE	Jan'y 18, 1884,	Philadelphia.
1832.	BACHE, THOMAS HEWSON	Feb'y 2, 1877,	"
1630.	BAIRD, HENRY CAREY	Jan'y 15, 1869,	"
1991.	BAIRD, HENRY M.	Jan'y 18, 1884,	Yonkers, N. Y.
2075.	BAKER, WILLIAM S.	May 21, 1886,	Philadelphia.
2191.	BALL, ROBERT	May 15, 1891,	Dublin, Ireland.
1936.	BARBER, EDWIN ATLEE	April 15, 1881,	West Chester, Pa.
1818.	BARCENA, MARIANO	Feb'y 2, 1877,	Mexico.
1741.	BARKER, GEORGE F.	April 18, 1873,	Philadelphia.
2011.	BARKER, WHARTON	April 18, 1884,	"
2144.	BARNARD, WILLIAM T.	May 20, 1887,	Boonton, N. J.
1902.	BARTHOLOW, ROBERTS	April 16, 1880,	Philadelphia.
1133.	BARTLETT, W. H. C.	April 17, 1840,	Yonkers, N. Y.
2119.	BASTIAN, ADOLPH	Dec. 17, 1886,	Berlin, Germany.
1968.	BELL, ALEXANDER GRAHAM	July 21, 1882,	Washington.
1966.	BELL, JOSEPH SNOWDEN	July 21, 1882,	Philadelphia.
1802.	BELL, LOWTHIAN	April 21, 1876,	Newcastle-on-Tyne, England.
2149.	BIDDLE, ALEXANDER	Feb'y 17, 1888,	Philadelphia.
2154.	BIDDLE, ARTHUR	Dec. 21, 1888,	"
1920.	BIDDLE, CADWALADER	Oct. 15, 1880,	"
1831.	BIDDLE, CRAIG	Feb'y 2, 1877,	"
2134.	BILLINGS, JOHN S.	Feb'y 18, 1887,	Washington, D. C.
2157.	BLAIR, ANDREW A.	May 17, 1889,	Philadelphia.
1554.	*Blair, Thomas S.*	Jan'y 19, 1866,	*Pittsburgh, Pa.*
1669.	BLAKE, WILLIAM PHIPPS	Oct. 21, 1870,	New Haven, Conn.
1790.	BLASIUS, WILLIAM	Oct. 15, 1875,	Philadelphia.
1700.	BLODGET, LORIN	April 19, 1872,	"
1444.	BÖHTLINGK, OTTO	Jan'y 17, 1862,	Leipzig, Germany.
2047.	BONWILL, W. G. A.	Oct. 16, 1885,	Philadelphia.
1126.	BOYÉ, MARTIN H.	Jan'y 17, 1840,	Coopersburg, Pa.
1826.	BRACKETT, CYRUS FOGG	Feb'y 2, 1877,	Princeton, N. J.
2083.	BRANNER, JOHN C.	May 21, 1886,	Palo Alto, Cal.
2195.	BREZINA, ARISTIDES	May 21, 1886,	Vienna, Austria.
1636.	BRINTON, DANIEL G.	April 16, 1869,	Philadelphia.
2069.	BRINTON, JOHN H.	Feb'y 19, 1886,	"
1745.	BRITTON, J. BLODGETT	Oct. 17, 1873,	"
2080.	BROOKS, WILLIAM KEITH	May 21, 1886,	Baltimore, Md.
1881.	BROWN, ARTHUR ERWIN	April 18, 1879,	Philadelphia.
1333.	BROWN-SEQUARD, E.	Jan'y 20, 1854,	Paris, France.
1614.	BRUGSH, HENRI	Jan'y 15, 1869,	Berlin, Prussia.
1547.	BRUSH, GEORGE J.	Jan'y 20, 1865,	New Haven, Conn.
1653.	BULLOCK, CHARLES	Oct. 15, 1869,	Philadelphia.
1452.	BUNSEN, ROBERT W.	Jan'y 17, 1862,	Heidelberg, Germany.
2008.	BURK, ISAAC	Jan'y 18, 1884,	Philadelphia.
2007.	BURK, JESSE Y.	Jan'y 18, 1884,	"
1938.	BUTLER, WILLIAM	April 15, 1881,	West Chester, Pa.

C

1788.	CAMPBELL, JOHN LYLE	July 16, 1875,	Crawfordsville, Ind.
1606.	CANBY, WILLIAM MARRIATT	Oct. 16, 1868,	Wilmington, Del.
2051.	CANNIZZARO, TOMMASO	Oct. 16, 1885,	Messina, Italy.
1731.	CAPELLINI, GIOVANNI	April 18, 1873,	Bologna, Italy.
1796.	CARLL, J. F.	Oct. 15, 1875,	Pleasantville, Pa.
2130.	CARRILLO, CRESCENCIO	Dec. 17, 1886,	Merida, Yucatan.

	Name.	Date of Election.	Present Address.
1995.	BACHE, R. MEADE	Jan'y 18, 1884,	Philadelphia.
1832.	BACHE, THOMAS HEWSON	Feb'y 2, 1877,	"
1630.	BAIRD, HENRY CAREY	Jan'y 15, 1869,	"
1991.	BAIRD, HENRY M.	Jan'y 18, 1884,	Yonkers, N. Y.
2075.	BAKER, WILLIAM S.	May 21, 1886,	Philadelphia.
2191.	BALL, ROBERT	May 15, 1891,	Dublin, Ireland.
1936.	BARBER, EDWIN ATLEE	April 15, 1881,	West Chester, Pa.
1818.	BARCENA, MARIANO	Feb'y 2, 1877,	Mexico.
1741.	BARKER, GEORGE F.	April 18, 1873,	Philadelphia.
2011.	BARKER, WHARTON	April 18, 1884,	"
2144.	BARNARD, WILLIAM T.	May 20, 1887,	Boonton, N. J.
1902.	BARTHOLOW ROBERTS	April 16, 1880,	Philadelphia.
1133.	BARTLETT, W. H. C.	April 17, 1840,	Yonkers, N. Y.
2119.	BASTIAN, ADOLPH	Dec. 17, 1886,	Berlin, Germany.
1963.	BELL, ALEXANDER GRAHAM	July 21, 1882,	Washington.
1966.	BELL, JOSEPH SNOWDEN	July 21, 1882,	Philadelphia.
1802.	BELL, LOWTHIAN	April 21, 1876,	Newcastle-on-Tyne, England.
2149.	BIDDLE, ALEXANDER	Feb'y 17, 1888,	Philadelphia.
2154.	BIDDLE, ARTHUR	Dec. 21, 1888,	"
1920.	BIDDLE, CADWALADER	Oct. 15, 1880,	"
1831.	BIDDLE, CRAIG	Feb'y 2, 1877,	"
2134.	BILLINGS, JOHN S.	Feb'y 18, 1887,	Washington, D. C.
2157.	BLAIR, ANDREW A.	May 17,'1889,	Philadelphia.
1554.	*Blair, Thomas S.*	Jan'y 19, 1866,	*Pittsburgh, Pa.*
1669.	BLAKE, WILLIAM PHIPPS	Oct. 21, 1870,	New Haven, Conn.
1790.	BLASIUS, WILLIAM	Oct. 15, 1875,	Philadelphia.
1700.	BLODGET, LORIN	April 19, 1872,	"
1444.	BOHTLINGK, OTTO	Jan'y 17, 1862,	Leipzig, Germany.
2047.	BONWILL, W. G. A.	Oct. 16, 1885,	Philadelphia.
1126.	BOYÉ, MARTIN H.	Jan'y 17, 1840,	Coopersburg, Pa.
1826.	BRACKETT, CYRUS FOGG	Feb'y 2, 1877,	Princeton, N. J.
2083.	BRANNER, JOHN C.	May 21, 1886,	Palo Alto, Cal.
2195.	BREZINA, ARISTIDES	May 21, 1886,	Vienna, Austria.
1636.	BRINTON, DANIEL G.	April 16, 1869,	Philadelphia.
2069.	BRINTON, JOHN H.	Feb'y 19, 1886,	"
1745.	BRITTON, J. BLODGETT	Oct. 17, 1873,	"
2080.	BROOKS, WILLIAM KEITH	May 21, 1886,	Baltimore, Md.
1881.	BROWN, ARTHUR ERWIN	April 18, 1879,	Philadelphia.
1333.	BROWN-SEQUARD, E.	Jan'y 20, 1854,	Paris, France.
1614.	BRUGSH, HENRI	Jan'y 15, 1869,	Berlin, Prussia.
1547.	BRUSH GEORGE J.	Jan'y 20, 1865,	New Haven, Conn.
1653.	BULLOCK, CHARLES	Oct. 15, 1869,	Philadelphia.
1452.	BUNSEN, ROBERT W.	Jan'y 17, 1862,	Heidelberg, Germany.
2008.	BURK, ISAAC	Jan'y 18, 1884,	Philadelphia.
2007.	BURK, JESSE Y.	Jan'y 18, 1884,	"
1938.	BUTLER, WILLIAM	April 15, 1881,	West Chester, Pa.

C

1788.	CAMPBELL, JOHN LYLE	July 16, 1875,	Crawfordsville, Ind.
1606.	CANBY, WILLIAM MARRIATT	Oct. 16, 1868,	Wilmington, Del.
2051.	CANNIZZARO, TOMMASO	Oct. 16, 1885,	Messina, Italy.
1781.	CAPELLINI, GIOVANNI	April 18, 1873,	Bologna, Italy.
1796.	CARLL, J. F.	Oct. 15, 1875,	Pleasantville, Pa.
2130.	CARRILLO, CRESCENCIO	Dec. 17, 1886,	Merida, Yucatan.

	Name.	*Date of Election.*	*Present Address.*
1911.	CARSON, HAMPTON L.	April 16, 1890,	Philadelphia.
1707.	CASSATT, ALEXANDER JOHNSON	Oct. 18, 1872,	"
2147.	CASTNER, SAMUEL, JR.	Dec. 16, 1887,	"
2152.	CATTELL, J. MCKEEN	May 18, 1888,	New York, N. Y.
1675.	CATTELL, WILLIAM C.	Jan'y 20, 1871,	Philadelphia.
1908.	CHANCE, HENRY MARTYN	April 16, 1890,	"
1783.	CHANDLER, C. F.	April 16, 1875,	New York, N. Y.
1778.	CHAPMAN, HENRY C.	April 16, 1875,	Philadelphia.
2132.	CHARENCEY, COMTE HYACINTH DE	Dec. 17, 1886,	St. Maurice les Charencey, France.
2111.	CHILDS, GEORGE W.	Dec. 17, 1886,	Philadelphia.
2158.	CLARK, CLARENCE H.	May 17, 1889,	"
1717.	CLARKE, THOMAS C.	Jan'y 17, 1873,	New York, N. Y.
1983.	CLAYPOLE, E. W.	Jan'y 19, 1883,	Akron, Ohio.
2048.	CLEEMANN, T. M.	Oct. 16, 1885,	Philadelphia.
1876.	CLOISEAUX, DES, A.	Oct. 18, 1879,	Paris, France.
1999.	COHEN, J. SOLIS	Jan'y 18, 1884,	Philadelphia.
2005.	COLERIDGE, LORD	Jan'y 18, 1884,	London, England.
1555.	COPE, EDWARD D.	Jan'y 19, 1866,	Philadelphia.
1367.	COPPÈE, HENRY	Jan'y 18, 1856,	Bethlehem, Pa.
2129.	CORA, GUIDO	Dec. 17, 1886,	Turin, Italy.
1474.	CORNELIUS, ROBERT	Oct. 17, 1862,	Philadelphia.
1867.	COUES, ELLIOTT	Sept. 20, 1878,	Washington, D. C.
1662.	COX, J. D.	April 15, 1870,	Cincinnati, O.
1672.	COXE, ECKLEY B.	Oct. 21, 1870,	Drifton, Pa.
2207.	CHARLES H. CRAMP	Dec. 16, 1892,	Philadelphia.
1836.	CRANE, THOMAS F.	Feb'y 2, 1877,	Ithaca, N. Y.
1393.	CRESSON, CHARLES M.	April 17, 1857,	Philadelphia.
2100.	CROOKES, WILLIAM	May 21, 1896,	London, England.
2172.	CRUZ, FERNANDO (of Guatemala)	Dec. 20, 1889.	
1439.	CURWEN, JOHN	April 18, 1861,	Warren, Pa.

D

1567.	DA COSTA, J. M.	Oct. 19, 1866,	Philadelphia.
1354.	DANA, JAMES D	July 21, 1854,	New Haven, Conn.
1806.	DANNEFELD, C. JUHLIN	April 21, 1876,	Stockholm, Sweden.
1516.	DAUBRÉE, A.	July 17, 1863,	Paris, France.
1811.	DAVENPORT, SAMUEL.	Oct. 20, 1876,	Adelaide, S. Australia.
1557.	DAVIDSON, GEORGE.	Jan'y 19, 1866,	San Francisco, Cal.
1923.	DAWKINS, WILLIAM B	Oct. 15, 1880,	Manchester, England.
1468.	DAWSON, JOHN W	April 18, 1862,	Montreal, Canada.
2131.	DELGADO, JUAN DE DIAS DE LA RADA Y.	Dec. 17, 1886,	Madrid, Spain.
2013.	DICKSON, SAMUEL	April 18, 1884,	Philadelphia.
2208.	DIXON, SAMUEL G.	Dec. 16. 1892,	"
2108.	DOLLEY, CHARLES S.	Dec. 17, 1886,	"
2089.	DONNER, OTTO.	May 21, 1886,	Helsingfors, Finland.
1946.	DOOLITTLE, C. L.	Oct. 21, 1881,	Bethlehem, Pa.
1839.	DOUGLASS, JAMES, JR.	April 20, 1877,	Spuytenduyvil, N. Y.
1924.	DRAPER, DANIEL	Oct. 15, 1880,	New York, N. Y.
2200.	DREXEL, A. J.	Feb'y 19, 1892,	Philadelphia.
1787.	DROWN, THOMAS M	July 16, 1875,	Boston, Mass.
1918.	DU BOIS, PATTERSON	Oct. 15, 1880,	Philadelphia.
1878.	DUDLEY, CHARLES BENJAMIN	Jan'y 17, 1879,	Altoona, Pa.
1921.	DUDLEY, THOMAS H	Oct. 15, 1880,	Camden, N. J.
2063.	DUNCAN, LOUIS	Feb'y 19, 1886,	U. S. Navy.

	Name.	Date of Election.		Present Address.
1573.	DUNNING, GEORGE P.	Jan'y	18, 1867,	Farmington, Conn.
1727.	DUPONT, [illegible]	April	18, 1873,	Brussels, Belgium.
2066.	DUPUY, [illegible]	May	21, 1886,	Paris, France.
1678.	DUTTON, CHARLES E.	Jan'y	20, 1871,	Washington, D. C.

Name.	Date of Election.	Present Address.
DIETZ, FRANCIS X. . .	[illegible]	[illegible]

2180.	FIELD, ROBERT PATTERSON . . .	May	[illegible]	
1901.	FLINT, AUSTIN, JR	April	16, 1880,	New York, N. Y.
1621.	FLOWER, WM. HENRY.	Jan'y	15, 1869,	London, England.
1875.	FOGGO, EDWARD A.	Oct.	18, 1879,	Philadelphia.
2197.	FORBES, GEORGE	Oct.	16, 1891,	London, England.
1170.	FRALEY, FREDERICK	July	15, 1842,	Philadelphia.
1912.	FRALEY, JOSEPH C.	April	16, 1880,	"
1695.	FRAZER, PERSIFOR	Jan'y	19, 1872,	"
2171.	FRIEBIS, GEORGE	Dec.	20, 1889,	"
1459.	FROUDE, J. A.	Jan'y	17, 1862,	London, England.
2179.	FULLERTON, GEORGE S.	May	16, 1890,	Philadelphia.
1739.	FULTON, JOHN.	April	18, 1873,	Johnstown, Pa.
1914.	FURNESS, HORACE HOWARD . . .	April	16, 1880,	Philadelphia.
1130.	FURNESS, WILLIAM H.	April	17, 1840,	"

G

1988.	GARRETT, PHILIP C	April	21, 1883,	Philadelphia.
2079.	GATES, M. E.	May	21, 1886,	Amherst, Mass.
1025.	GATSCHET, ALBERT S.	Oct.	17, 1884,	Washington, D. C.
1897.	GEIKIE, ARCHIBALD	Jan'y	16, 1880,	London, England.
1903.	GEIKIE, JAMES.	April	21, 1876,	Edinburgh, Scotland.
1339.	GENTH, FRED. AUGUSTUS. . . .	Jan'y	20, 1854,	Philadelphia.
2067.	GENTH, F. A., JR.	Feb'y	19, 1886,	"
1355.	GIBBS, OLIVER WOLCOTT. . . .	July	21, 1854,	Cambridge, Mass.
1587.	GILL, THEODORE NICHOLAS . .	July	19, 1867,	Washington, D. C.
1800.	GILMAN, DANIEL C.	April	21, 1876,	Baltimore, Md.
1940.	*Giraldes, J. P. C. Cunvelo de.* . .	July	20, 1827.	
1950.	GLADSTONE, WM. EWART	Oct.	21, 1881,	London, England.
2162.	GOODE, G. BROWN	Oct.	18, 1889,	Washington, D. C.
1835.	GOODELL, WILLIAM	Feb'y	2, 1877,	Philadelphia.
1680.	GOODFELLOW, EDWARD.	Jan'y	20, 1871,	Washington, D. C.
2203.	GOODWIN, HAROLD	May	20, 1892,	Philadelphia.
1271.	GOULD, BEN. APTHORPE	Jan'y	17, 1851,	Cambridge, Mass.
1851.	GRAY, ELISHA.	Jan'y	18, 1878,	Chicago, Ill.
1605.	GREEN, TRAILL	Oct.	16, 1868,	Easton, Pa.
1504.	GREEN, WILLIAM HENRY	April	17, 1863,	Princeton, N. J.
1880.	GREENE, WILLIAM H.	April	18, 1879,	Philadelphia.
2155.	GREGORIO, IL MARCHESE ANTONIO DE	Dec.	21, 1888,	Palermo, Italy.

	Name.	*Date of Election.*	*Present Address.*
2159.	GREGORY, HENRY D.	May 17, 1889,	Philadelphia.
2188.	GREGORY, CASPAR RÉNÉ.	May 15, 1891,	Leipzig.
1229.	*Grimaldi, Ova*	Oct. 16, 1846,	*Naples, Italy.*
1939.	GRISCOM, WM. WOODNUTT . . .	April 15, 1881,	Haverford, Pa.
1815.	GROTE, AUGUSTUS RADCLIFFE . .	Oct. 20, 1876.	
2090.	GUBERNATIS, ANGELO DE	May 21, 1886,	Florence, Italy.
1438.	*Guyangos, Puscual de.*	April 19, 1861,	*Madrid, Spain.*

H

2054.	HAECKEL, ERNEST.	Oct. 16, 1885,	Jena, Prussia.
2066.	HAGEN, H. A.	Feb'y 19, 1886,	Cambridge, Mass.
1658.	HALE, EDW. EVERETT	Jan'y 21, 1870,	Roxbury, Mass.
1709.	HALE, HORATIO	Oct. 18, 1872,	Clinton, Canada.
1853.	HALL, ASAPH	Jan'y 18, 1878,	Washington, D. C.
1795.	HALL, CHARLES EDWARD	Oct. 15, 1875,	Westport, N. Y.
1356.	HALL, JAMES	July 21, 1854,	Albany, N. Y.
2027.	HALL, LYMAN B	Jan'y 16, 1885,	Haverford, Pa.
1412.	HAMMOND, WILLIAM A	Oct. 21, 1859,	New York, N. Y.
2194.	HAMY, E. T.	May 15. 1891,	Paris, France.
1337.	HARDING, GEORGE	Jan'y 20, 1854,	Philadelphia.
2136.	HARRIS, JOSEPH S.	May 20, 1887,	"
1827.	HART, JAMES MORGAN.	Feb'y 2, 1877,	Ithaca, N. Y.
1510.	HARTSHORNE, HENRY.	July 17, 1863,	Philadelphia.
1764.	HAUER, FRANZ RITTER VON. .	Oct. 16, 1874,	Vienna, Austria.
1681.	HAUPT, HERMANN.	April 21, 1871,	St. Paul, Minn.
1862.	HAUPT, LEWIS M.	May 3, 1878,	Philadelphia.
2082.	HAYES, R. SOMERS.	May 21, 1886,	New York, N. Y.
2071.	HAYS, J. MINIS	Feb'y 19, 1886,	Philadelphia.
2165.	HAZLEHURST, HENRY	Oct. 18, 1889,	"
1985.	HEILPRIN, ANGELO	April 20, 1883,	"
1734.	HELMHOLTZ, HEINRICH	April 18, 1873,	Berlin, Prussia.
1963.	HILL, HAMILTON ANDREWS . . .	April 21, 1882,	Boston, Mass.
2110.	HILPRECHT, HERMANN V.	Dec. 17, 1886,	Philadelphia.
1768.	HIMES, CHARLES FRANCIS . . .	Oct. 16, 1874,	Carlisle, Pa.
1663.	HITCHCOCK, CHARLES HENRY . .	April 15, 1870,	Hanover, N. H.
2160.	HOFFMAN, WALTER J.	Oct. 18, 1889,	Washington, D. C.
2068.	HOLLAND, JAMES W.	Feb'y 19, 1886,	Philadelphia.
1898.	HOLMES, OLIVER WENDELL . . .	Jan'y 16, 1880,	Boston, Mass.
1624.	HOOKER, JOSEPH D.	Jan'y 15, 1869,	London, England.
1652.	HOPPER, EDWARD	Oct. 15. 1869,	Philadelphia.
1607.	HORN, GEORGE HENRY	Oct. 16, 1868,	"
2070.	HORNER, INMAN.	Feb'y 19, 1886,	"
1941.	HOTCHKISS, JEDEDIAH.	Oct. 21, 1881,	Staunton, Va.
1696.	HOUGH, GEORGE W.	Jan'y 19, 1872,	Chicago, Ill.
1698.	HOUSTON, EDWIN J.	Jan'y 19, 1872,	Philadelphia.
2143.	HOUSTON, HENRY H	May 20, 1887,	"
2084.	HOVELACQUE, ABEL	May 21, 1886,	Paris, France.
1843.	HUMPHREY, H. C	July 20, 1877,	
2211.	HUMPHREY, JAMES ELLIS	Dec. 16, 1892,	Amherst, Mass.
1623.	HUXLEY, THOMAS HENRY	Jan'y 15, 1869,	London, England.
1426.	HYRTL, JOSEPH	July 20, 1860,	Vienna, Austria.

I

2052.	IM THURN, EVERARD F.	Oct. 16, 1885,	Georgetown, British Guiana.
1773.	INGHAM, WM. ARMSTRONG. . . .	April 16, 1875,	Philadelphia.

J

	Name.	*Date of Election.*	*Present Address.*
2010.	JAMES, EDMUND J	April 18, 1884,	Philadelphia.
1933.	JANNET, CLAUDIO	April 15, 1881,	Paris, France.
2049.	JAYNE, HORACE	Oct. 16, 1885,	Philadelphia.
1954.	JEFFERIS, WILLIAM W	Jan'y 20, 1882,	"
1942.	JONES, CHARLES C., JR.	Oct. 21, 1881,	Augusta, Ga.
2017.	JORDAN, FRANCIS, JR.	April 18, 1884,	Philadelphia.

K

1989.	KANE, ELISHA KENT.	April 20, 1883,	Kane, Pa.
2169.	KEANE, JOHN J.	Dec. 20, 1889,	Washington, D. C.
1348.	KEATING, WILLIAM V	April 21, 1854,	Philadelphia.
2021.	KEEN, WILLIAM W.	July 18, 1884,	"
1962.	KEIM, GEO. DE BENNEVILLE.	April 21, 1882,	"
2118.	KIEPERT, HENRI.	Dec. 17, 1886,	Berlin, Prussia.
1161.	KENDALL, E. OTIS	Jan'y 21, 1842,	Philadelphia.
1708.	KING, CLARENCE	Oct. 18, 1872,	New York, N. Y.
1284.	KIRKWOOD, DANIEL	April 18, 1851,	Riverside, Cal.
1767.	KÖNIG, GEORGE A	Oct. 16, 1874,	Houghton, Mich.
2167.	KRAUSS, FRIEDERICH S	Dec. 21, 1889,	Vienna, Austria.

L

1026.	*Labouderie, J.*	April 19, 1833,	*Paris, France.*
1694.	LAMBERT, GUILLAUME.	Jan'y 19, 1872,	Louvain, Belgium.
1858.	LANDRETH, BURNET.	Jan'y 18, 1878,	Bristol, Pa.
1781.	LANGLEY, SAMUEL P.	April 16, 1875,	Washington, D. C.
1721.	LA ROCHE, C. PERCY	Jan'y 17, 1873,	Rome, Italy.
1711.	LAUTH, FRANZ JOSEPH	Oct. 18, 1872,	Munich, Bavaria.
1974.	LAWES, JOHN BENNETT	Jan'y 19, 1883,	Rothamstead, Herts, Eng.
1595.	LEA, HENRY CHARLES.	Oct. 18, 1867,	Philadelphia.
1737.	LE CONTE, JOSEPH.	April 18, 1873,	Berkeley, Cal.
2125.	LEEMANS, CONRAD.	Dec. 17, 1886,	Leyden, Holland.
1986.	LEHMAN, AMBROSE E.	April 20, 1883,	Philadelphia.
2182.	LELAND, CHARLES G.	May 16, 1890,	London, Eng.
2174.	LE MOINE, J. M.	Dec. 20, 1889,	Quebec, Canada.
1934.	LE ROY-BEAULIEU, PAUL	April 15, 1881,	Paris, France.
1382.	LESLEY, J. PETER	July 13, 1856,	Philadelphia.
1376.	LETCHWORTH, ALBERT S.	Jan'y 18, 1856,	"
2085.	LEVASSEUR, EMILE.	May 21, 1886,	Paris, France.
1415.	LEWIS, FRANCIS W.	Jan'y 20, 1860,	Philadelphia.
1383.	*Leyburn, John.*	July 13, 1856,	*Baltimore, Md.*
1756.	LOCKYER, JOSEPH NORMAN.	April 17, 1874,	London, England.
2202.	LOW, SETH	Feb. 19, 1892,	New York, N. Y.
1872.	LONGSTRETH, MORRIS	Sept. 20, 1878,	Philadelphia.
1015.	*Lorin, Theodore*	April 20, 1832,	*Paris, France.*
2019.	LUBBOCK, JOHN	July 18, 1881,	London, England.
2003.	LUDLOW, WILLIAM.	Jan'y 18, 1884,	U. S. A.
1629.	LYMAN, BENJAMIN SMITH	Jan'y 15, 1869,	Philadelphia.

M

1058.	*Macedo, J. L. DaCosta*	April 15, 1836,	*Lisbon, Portugal.*
2209.	MACFARLANE, JOHN M.	Dec. 16, 1892,	Lansdowne, Pa.
1994.	MAISCH, JOHN M.	Jan'y 18, 1884,	Philadelphia.
1970.	MALLERY, GARRICK, JR	Oct. 20, 1882,	Washington, D. C.
2042.	MALLET, JOHN WM.	Jan'y 16, 1885,	University of Virginia, Va

	Name.	*Date of Election.*	*Present Address.*
1847.	MANSFIELD, IRA FRANKLIN . . .	Jan'y 18, 1878,	Cannelton, Pa.
1857.	MARCH, FRANCIS ANDREW . . .	Jan'y 18, 1878,	Easton, Pa.
1961.	MARKS, WILLIAM D	May 3, 1878,	Philadelphia.
1604.	MARSH, OTHNIEL C	Oct. 16, 1868,	New Haven, Conn.
2078.	MARSHALL, JOHN	May 21, 1886,	Philadelphia.
1018.	*Martinez, Juan José*	April 20, 1832,	*Spain.*
2184.	MASCART, E.	Dec. 19, 1890,	Paris, France.
1572.	MASON, ANDREW	Jan'y 18, 1867,	New York, N. Y.
2196.	MASPERO, GASTON	May 15, 1891,	Paris, France.
1654.	MAYER, ALFRED M	Oct. 15, 1869,	Hoboken, N. J.
2107.	MCALISTER, JAMES	Dec. 17, 1886,	Philadelphia.
1928.	MCCAULEY, EDWARD Y	Jan'y 21, 1881,	"
1685.	MCCOSH, JAMES	April 21, 1871.	
1888.	MCCREATH, ANDREW S.	July 18, 1879,	Harrisburg, Pa.
1821.	MCKEAN, WILLIAM V.	Feb'y 2, 1877,	Philadelphia.
2004.	MCMASTER, JOHN BACH	Jan'y 18, 1884,	"
1677.	MEEHAN, THOMAS	Jan'y 20, 1871,	"
1903.	MERRICK, JOHN VAUGHAN . . .	April 16, 1880,	"
1947.	MERRIMAN, MANSFIELD	Oct. 21, 1881,	Bethlehem, Pa.
1744.	MESSCHERT, MATHEW HUIZINGA.	Oct. 17, 1873,	Douglassville, Pa.
2142.	MICHAEL, HELEN ABBOTT. . . .	May 20, 1887,	Philadelphia.
2175.	MITCHELL, JAMES T.	Feb'y 21, 1890,	"
1461.	MITCHELL, S. WEIR	Jan'y 17, 1862,	"
2114.	MONIER-WILLIAMS, MONIER . . .	Dec. 17, 1886,	London, England.
1791.	MOORE, GIDEON E	Oct. 15, 1875,	New York, N. Y.
2029.	MOORE, JAMES W	Jan'y 16, 1885,	Easton, Pa.
1841.	MOREHOUSE, GEORGE R	April 20, 1877,	Philadelphia.
1054.	*Morelli.*	Jan'y 15, 1836,	*Naples, Italy.*
1976.	MORRIS, J. CHESTON.	Jan'y 19, 1883,	Philadelphia.
1577.	MORTON, HENRY	Jan'y 18, 1867,	Hoboken, N. J.
2121.	MUCH, MATTHÆUS.	Dec. 17, 1886,	Vienna, Austria.
1866.	MÜHLENBERG, F. A.	Sept. 20, 1878,	Greenville, Pa.
2120.	MUELLER, FRIEDERICH	Dec. 17, 1886,	Vienna, Austria.
1486.	MUELLER, F. MAX.	Jan'y 16, 1863,	Oxford, England.
2192.	MUNROE, CHARLES E.	May 15, 1891,	Washington, D. C.
1892.	MUONI, DAMIANO	Jan'y 16, 1880,	Milan, Italy.
2062.	MURDOCK, J. B.	Feb'y 19, 1886,	U. S. Navy.
1937.	MURRAY, JAMES A. H.	April 15, 1881,	Oxford, England.

N

2087.	NADAILLAC, MARQUIS DE.	May 21, 1886,	Paris, France.
1852.	NEWCOMB, SIMON	Jan'y 18, 1878,	Washington, D. C.
1582.	NEWTON, HUBERT ANSON	April 19, 1869,	New Haven, Conn.
1703.	NICHOLS, STARR HOYT	July 19, 1872,	New York, N. Y.
2060.	NIKITIN, SERGE	Feb'y 19, 1886,	St. Petersburg, Russia.
1805.	NORDENSKIÖLD, ADOLF ERIC . .	April 21, 1876,	Stockholm, Sweden.
1712.	NORRIS, ISAAC.	Oct. 18, 1872,	Philadelphia.
2106.	NORRIS, WILLIAM F.	Dec. 17, 1886,	"
2046.	NORTH, EDWARD.	Oct. 16, 1885,	Clinton, N. Y.

O

2072.	OLIVER, CHARLES A.	Feb'y 19, 1886,	Philadelphia.
1715.	OLIVER, JAMES E.	Jan'y 17, 1873,	Ithaca, N. Y.
2195.	OPPERT, JULES.	May 15, 1891,	Paris, France.
2135.	OSBORN, HENRY F.	Feb'y 18, 1887,	Princeton, N. J.
1581.	OSBORN, HENRY S.	Jan'y 18, 1867,	Oxford, O.
2039.	OSLER, WILLIAM	Jan'y 16, 1885,	Baltimore, Md.
1801.	OWEN, P. CUNLIFFE	April 21, 1876,	London, England.



	Name.	Date of Election.	Present Address.
1868.	PACKARD, A. S., JR.	Sept. 20, 1878,	Providence, R. I.
1578.	PACKARD, JOHN H.	Jan'y 18, 1867,	Philadelphia.
1331.	PAGET, JAMES	Jan'y 20, 1854,	London, England.
1984.	PANCOAST, WILLIAM HENRY	Jan'y 19, 1883,	Philadelphia.
1673.	PARIEU, ESQUIRON DE	Jan'y 20, 1871,	Paris, France.
2036.	PARVIN, THEOPHILUS	Jan'y 16, 1885,	Philadelphia.
2056.	PASTEUR, LOUIS	Oct. 16, 1885,	Paris, France.
2035.	PATTERSON, C. STUART	Jan'y 16, 1885,	Philadelphia.
1282.	PATTERSON, ROBERT	April 18, 1851,	"
1320.	PATTERSON, THOMAS L.	April 15, 1853,	Cumberland, Md.
1772.	PEARSE, JOHN B.	Jan'y 15, 1875.	*Boston, Mass.*
1859.	PEIRCE, C. NEWLIN	May 3, 1878.	Philadelphia.
1722.	PEMBERTON, HENRY	Jan'y 17, 1873,	"
2104.	PEÑAFIEL, ANTONIO	May 21, 1886,	Mexico.
2073.	PENNYPACKER, SAMUEL W.	May 21, 1886,	Philadelphia.
1518.	PENROSE, R. A. F.	July 17, 1863,	"
2059.	PEPPER, EDWARD	Feb'y 19, 1886,	Paris.
1666.	PEPPER, WILLIAM	July 15, 1870,	Philadelphia.
951.	*Pereira, José Maria Dantes.*	April 18, 1828,	*Lisbon, Portugal.*
1705.	PETER, ROBERT	July 19, 1872.	Lexington, Ky.
1824.	PHILLIPS, HENRY, JR.	Feb'y 2, 1877,	Philadelphia.
1760.	PLATT, FRANKLIN	July 17, 1874,	"
2127.	PLATZMAN, JULIUS	Dec. 17, 1886,	Leipzig, Germany.
2053.	POMIALOWSKY, JOHN	Oct. 16, 1885,	St. Petersburg, Russia.
1539.	PORTER, THOMAS CONRAD	Oct. 21, 1864,	Easton, Pa.
2203.	POTTS, JOSEPH D.	May 20, 1892,	Philadelphia.
2044.	POTTS, WILLIAM JOHN	Oct. 16, 1885,	Camden, N. J.
2097.	POSTGATE, J. P	May 21, 1886,	Cambridge, England.
2161.	POWELL, J. W.	Oct. 18, 1889,	Washington, D. C.
1619.	PRESTWICH, JOSEPH	Jan'y 15, 1869,	Shoreham, England.
1592.	PRICE, J. SERGEANT	Oct. 18, 1867.	Philadelphia.
1780.	PRIME, FREDERICK, JR	April 16, 1875,	"
2088.	PULZSKY, FRANCIS	May 21, 1886,	Buda-Pesth, Hungary.
1758.	PUMPELLY, RAPHAEL	April 17, 1874,	Newport, R. I.

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973.	*Quadrada, Francisco de Paolo*	Oct. 16, 1829,	*Madrid, Spain.*
1143.	*Quaranta, Barnardo.*	Jan'y 15, 1841,	*Naples, Italy.*

R

1736.	RAND, THEODORE D.	April 18, 1873,	Philadelphia.
1849.	RANDALL, F. A.	Jan'y 18, 1878,	Warren, Pa.
1644.	RAWLINSON, GEORGE.	Oct. 15, 1869,	Oxford, England.
1765.	RAWSON, RAWSON W	Oct. 16, 1874,	London, "
2099.	RAYLEIGH, LORD	May 21, 1886,	Essex, England.
1784.	RAYMOND, ROSSITTER W	April 16, 1875,	New York, N. Y.
1585.	RAYNOLDS, WILLIAM F.	April 19, 1867,	Detroit, Mich.
1591.	READ, JOHN MEREDITH	July 19, 1867.	
2077.	REED, HENRY	May 21, 1886,	Philadelphia.
1889.	REMSEN, IRA	July 18, 1879,	Baltimore, Md.
1948.	RENARD, A	Oct. 21, 1881,	Brussels, Belgium.
1343.	RENARD, CHARLES	Jan'y 20, 1854,	Moscow, Russia.
1890.	RENEVIER, E.	July 18, 1879,	Lausanne, Switzerland.

	Name.	*Date of Election.*	*Present Address.*
1816.	REULEAUX, F.	Feb'y 2, 1877,	Berlin, Prussia.
2122.	RÉVILLE, ALBERT	Dec. 17, 1886,	Paris, France.
1500.	RICHARDSON, BEN. WARD . . .	April 17, 1863,	London, England.
1808.	RILEY, CHARLES V	April 21, 1876,	Washington, D. C.
1957.	ROBINS, JAMES W	April 21, 1882,	Philadelphia.
1390.	ROGERS, FAIRMAN.	Jan'y 16, 1857,	Newport, R. I.
2177.	ROGERS, ROBERT W	Feb'y 21, 1890,	Carlisle, Pa.
1906.	ROGERS, WILLIAM B., JR	April 16, 1880,	Philadelphia.
1462.	RÖHRIG, F. L. O.	April 18, 1862,	Los Angeles, Cal.
2050.	ROLLETT, HERMANN	Oct. 16, 1885,	Vienna, Austria.
1907.	ROOD, OGDEN N	April 16, 1880,	New York, N. Y.
1964.	ROSNY, DE, LÉON	July 21, 1882,	Paris, France.
1732.	ROSSI, GIOVANNI BATTISTA. . . .	April 18, 1873,	Rome, Italy.
2198.	ROSENGARTEN, JOSEPH G.	Oct. 16, 1891,	Philadelphia.
1718.	ROTHERMEL, PETER F.	Jan'y 17, 1873,	Limerick P. O., Pa.
1838.	ROTHROCK, JOSEPH T.	April 20, 1877,	Philadelphia.
1264.	RUSCHENBERGER, WM. S. W. . . .	Oct. 19, 1849,	"
1620.	RUTIMEYER, CARL L.	Jan'y 15, 1869,	Basel, Switzerland.
2109.	RYDER, JOHN A	Dec. 17, 1886,	Philadelphia.

S

1766.	SADTLER, SAMUEL PHILIP	Oct. 16, 1874,	Philadelphia.
2148.	SAJOUS, CHARLES E.	Feb'y 17, 1888,	Paris, France.
1563.	SANDBERGER, FRIDOLIN	April 20, 1866,	Würtzburg, Bavaria.
1958.	SARGENT, CHARLES SPRAGUE . .	April 21, 1882,	Brookline, Mass.
1730.	SAUSSURE, HENRI DE.	April 18, 1873,	Geneva, Switzerland.
1877.	SCHORLEMMER, C.	Oct. 18, 1878,	Manchester, England.
1498.	SCHOTT, CHARLES ANTHONY . . .	April 17, 1863,	Washington, D. C.
1864.	SCHURZ, CARL	Sept. 20, 1878.	
1725.	SCLATER, PHILLIP LUTLEY. . . .	April 18, 1873,	London, England.
1919.	SCOTT, LEWIS A.	Oct. 15, 1880,	Philadelphia.
2112.	SCOTT, W. B.	Dec. 17, 1886,	Princeton, N. J.
1870.	SCUDDER, SAMUEL HUBBARD. . .	Sept. 20, 1878,	Cambridge, Mass.
1656.	SEIDENSTICKER, OSWALD	Jan'y 21, 1870,	Philadelphia.
1883.	SEILER, CARL	April 18, 1879,	"
1704.	SELLERS, COLEMAN	July 19, 1872,	"
1533.	SELLERS, WILLIAM.	April 15, 1864,	"
1770.	SELWYN, ALFRED R. C.	Oct. 16, 1874,	Montreal, Canada.
1728.	SELYS, DE, LONGCHAMPS.	April 18, 1873,	Liége, Belgium.
2057.	SERGI, GIUSEPPE	Oct. 16, 1885,	Rome, Italy.
1965.	SÈVE DE BAR, EDOUARD	July 21, 1882,	Ramsgate, England.
2076.	SHARP, BENJAMIN.	May 21, 1886,	Philadelphia.
1944.	SHARPLES, PHILIP PRICE	Oct. 21, 1881,	West Chester, Pa.
1960.	SHARPLES, STEPHEN PASCHALL. .	April 21, 1882,	Boston, Mass.
2002.	SHARPLESS, ISAAC	Jan'y 18, 1884,	Haverford, Pa.
1792.	SHEPPARD, FURMAN.	Oct. 15, 1875,	Philadelphia.
1797.	SHERWOOD, ANDREW	Oct. 15, 1875,	Mansfield, Pa.
1822.	SHIELDS, CHARLES W.	Feb'y 2, 1877,	Princeton, N. J.
1532.	*Shinz, Carl*.	April 15, 1863,	*Strasburg, Germany*. (?)
2146.	SMITH, EDGAR F.	Oct. 21, 1887,	Philadelphia.
1544.	SMITH, GOLDWIN.	Jan'y 20, 1865.	
1789.	SMITH, STEPHEN	Oct. 15, 1875,	New York, N. Y.
2141.	SMYTH, ALBERT H.	May 20, 1887,	Philadelphia.
1742.	SNOWDEN, A. LOUDON	Oct. 17, 1873,	"
2009.	SNYDER, MONROE B..	Jan'y 18, 1884,	"
2189.	SPANGLER, HENRY W	May 15, 1891,	"

	Name.	*Date of Election.*	*Present Address.*
1720.	SPOFFORD, A. R.	Jan'y 17, 1873,	Washington, D. C.
1949.	STALLO, JOHN B.	Oct. 21, 1881,	Cincinnati, O.
1446.	STEENSTRUP, J. J. S.	Jan'y 17, 1862,	Copenhagen, Denmark.
1990.	STEVENS, WALTER LECONTE	Jan'y 18, 1884,	Troy, N. Y.
1840.	STEVENSON, JOHN JAMES	April 20, 1877,	New York, N. Y.
2168.	STOKES, GEORGE G.	Dec. 20, 1889,	London, England.
1834.	STRAWBRIDGE, GEORGE	Feb'y 2, 1877,	Philadelphia.
1559.	STRONG, WILLIAM	Jan'y 19, 1866,	Washington, D. C.
1820.	STUART, GEORGE	Feb'y 2, 1877,	Philadelphia.
2193.	STUBBS, WILLIAM	May 15, 1891,	Oxford, England.
2093.	STUER, DIONYS	May 21, 1886,	Vienna, Austria.
2094.	SUESS, EDWARD	May 21, 1886,	" "
2023.	SYLE, E. W.	July 18, 1884,	Philadelphia.
1844.	SYLVESTER, J. J.	July 20, 1877,	Oxford, England.
2092.	SZOMBATHY, JOSEF	May 21, 1886,	Vienna, Austria.
	T		
1786.	TATHAM, WILLIAM P.	April 16, 1875,	Philadelphia.
1846.	TAYLOR, WILLIAM B.	Oct. 19, 1877,	Washington, D. C.
2098.	TEMPLE, RICHARD CARNAC	May 21, 1886,	Upper Burmah, India.
2006.	THOMAS, ALLEN C.	Jan'y 18, 1884,	Haverford, Pa.
1807.	THOMSON, ELIHU	April 21, 1876,	Swampscott, Mass.
1993.	THOMPSON, HEBER S.	Jan'y 18, 1884,	Pottsville, Pa.
1726.	THOMPSON, HENRY.	April 18, 1873,	London, England.
1755.	THOMPSON, ROBERT ELLIS	April 17, 1874,	Philadelphia.
1754.	THOMSON, FRANK	April 17, 1874,	"
1723.	THOMSON, WILLIAM	April 18, 1873,	London, England.
1909.	THOMSON, WILLIAM	April 16, 1880,	Philadelphia.
1530.	THURY, A.	April 15, 1864,	Geneva, Switzerland.
1688.	TILGHMAN, BENJAMIN C	July 21, 1871,	Philadelphia.
1233.	TILGHMAN, RICHARD A	April 16, 1847,	"
1657.	TILGHMAN, WILLIAM M.	Jan'y 21, 1870,	"
2176.	TIMMINS, SAMUEL	Feb. 21, 1890,	Arley, near Coventry, Eng.
2123.	TOPINARD, PAUL.	Dec. 17, 1886,	Paris, France.
2065.	TOPPAN, ROBERT NOXON.	Feb'y 19, 1886,	Cambridge, Mass.
1597.	TOWNSEND, JOSEPH B	Jan'y 17, 1868,	Philadelphia.
1955.	TOWNSEND, WASHINGTON	Jan'y 20, 1882,	West Chester, Pa.
1691.	TROWBRIDGE, WILLIAM P	Jan'y 19, 1872,	New York, N. Y.
2024.	TRUMBULL, HENRY CLAY	July 18, 1884,	Philadelphia.
1973.	TSCHERMAK, GUSTAF	Oct. 20, 1882,	Vienna, Austria.
1983.	TURRETTINI, THEODORE.	Dec. 19, 1890,	Geneva, Switzerland.
2166.	TUTTLE, DAVID K	Oct. 18, 1889,	Philadelphia.
2163.	TYLER, LYON G	Oct. 18, 1889.	Williamsburg, Va.
1529.	TUNNER, PETER	April 15, 1864,	Leoben, Austria.
1602.	TYNDALL, JOHN	April 17, 1868,	London, England.
2136.	TYSON, JAMES	May 20, 1887,	Philadelphia.
	U		
2185.	UNWIN, WILLIAM C	Dec. 19, 1890,	London, England.
	V		
2000.	VAUX, RICHARD.	Jan'y 18, 1884,	Philadelphia.
2045.	VERE, DE, SCHEELE M.	Oct. 16, 1885,	University of Virginia, Va.
1475.	VIRCHOW, RUDOLPH.	Oct. 17, 1862,	Berlin, Prussia.
1646.	VOGT, CARL	Oct. 15, 1869,	Geneva, Switzerland.
2115.	VON MELTZEL, HUGO	Dec. 17, 1886,	Koloszvar, Hungary.
1670.	VOSE, GEORGE LEONARD.	Oct. 21, 1870,	Boston, Mass.
2186.	VOSSION, LOUIS	Dec. 19, 1890,	Philadelphia.

W

	Name.	*Date of Election.*	*Present Address.*
2034.	WAGNER, SAMUEL	Jan'y 16, 1885,	Philadelphia.
1748.	WAHL, WILLIAM H.	Jan'y 16, 1874,	"
1724.	WALLACE, ALFRED R	April 18, 1873,	Parkston, Dorset, England.
2156.	WARD, LESTER F.	May 17, 1889,	Washington, D. C.
2033.	WEIL, EDWARD HENRY	Jan'y 16, 1885,	Philadelphia.
2028.	WEISBACH, ALBIN	Jan'y 16, 1885,	Freiburg, Saxony.
1639.	WHARTON, JOSEPH.	April 16, 1869,	Philadelphia.
1637.	WHITE, ANDREW D.	April 16, 1869,	Ithaca, N. Y.
1848.	WHITE, ISRAEL C.	Jan'y 18, 1878,	Morgantown, W. Va.
1487.	WHITNEY, JOSIAH DWIGHT	Jan'y 16, 1863,	Cambridge, Mass.
1502.	WHITNEY, WILLIAM DWIGHT.	April 17, 1863,	New Haven, Conn.
1863.	WILDER, BURT GREEN	May 3, 1878,	Ithaca, N. Y.
2151.	WILLIAMS, TALCOTT	May 18, 1888,	Philadelphia.
2178.	WILLIS, HENRY	Feb'y 21, 1890,	"
2150.	WILSON, EDMUND B	Feb'y 17, 1888,	Bryn Mawr, Pa.
2041.	WILSON, JAMES C.	Jan'y 16, 1885,	Philadelphia.
1747.	WILSON, JOSEPH M.	Jan'y 16, 1874,	"
2137.	WILSON, WILLIAM POWELL	May 20, 1887,	"
1896.	WINTHROP, ROBERT C.	Jan'y 16, 1880,	Boston, Mass.
2140.	WIREMAN, HENRY D.	May 20, 1887,	Philadelphia.
1561.	WISTER, OWEN JONES	April 20, 1866,	"
1884.	WOOD, RICHARD.	April 18, 1879,	"
1762.	WOODWARD, HENRY.	July 17, 1874,	London, England.
1751.	WOOTTEN, J. E.	Jan'y 16, 1874,	Reading, Pa.
1854.	WORMLEY, THEODORE G.	Jan'y 18, 1878,	Philadelphia.
1932.	WURTS, CHARLES STEWART	Jan'y 21, 1881,	"
2061.	WYCKOFF, A. B.	Feb'y 19, 1886,	U. S. Navy.

Y

1904.	YARNALL, ELLIS	April 16, 1880,	Philadelphia.
1759.	YOUNG, CHARLES AUGUSTUS	April 17, 1874,	Princeton, N. J.



time be awarded by the Society for the best essay of real merit on the Science and Philosophy of Jurisprudence, and to the preparation of the certificate to be granted to the author of any successful essay.

Fourth. Competitors for the prize shall affix to their essays some motto or name (not the proper name of the author, however), and when the essay is forwarded to the Society, it shall be accompanied by a sealed envelope containing within the proper name of the author, and, on the outside thereof, the motto or name adopted for the essay.

Fifth. At a stated meeting of the Society, in pursuance of the advertisement, all essays received up to that time shall be referred to a Committee of Judges, to consist of five persons, who shall be selected by the Society from nomination of ten persons made by the Standing Committee on the Henry M. Phillips' Prize Essay Fund.

Sixth. All amounts of interest accruing and unexpended on each and every occasion on which no prize shall be awarded, shall be considered and taken as accretions to the principal of the said fund.

Seventh. All essays may be written in English, French, German, Dutch, Italian, Spanish or Latin; but, if any language except English, must be accompanied by an English translation of the same.

Eighth. No treatise or essay shall be entitled to compete for the prize that has been already published or printed, or for which the author has received already any prize, or profit, or honor, of any nature whatsoever.

Ninth. All essays must be clearly and legibly written on only one side of the paper.

Tenth. The literary property of such essays shall be in their authors, subject to the right of the Society to publish the crowned essays in its Transactions or Proceedings.

Eleventh. A Standing Committee, to consist of five members appointed by the President, and *ex officio*, the President and the Treasurer of the Society, shall continue in office during the pleasure

the Society, on the first Friday in December, all its transaction
with an account of the investment of the Prize Fund, and of t
income and expenditures thereof.

The first prize to be awarded by the Society will
the sum of one thousand dollars, lawful gold coin of t
United States of America, and all treatises in compet
tion therefor must be in the possession of the Socie
before the first day of January, 1893.

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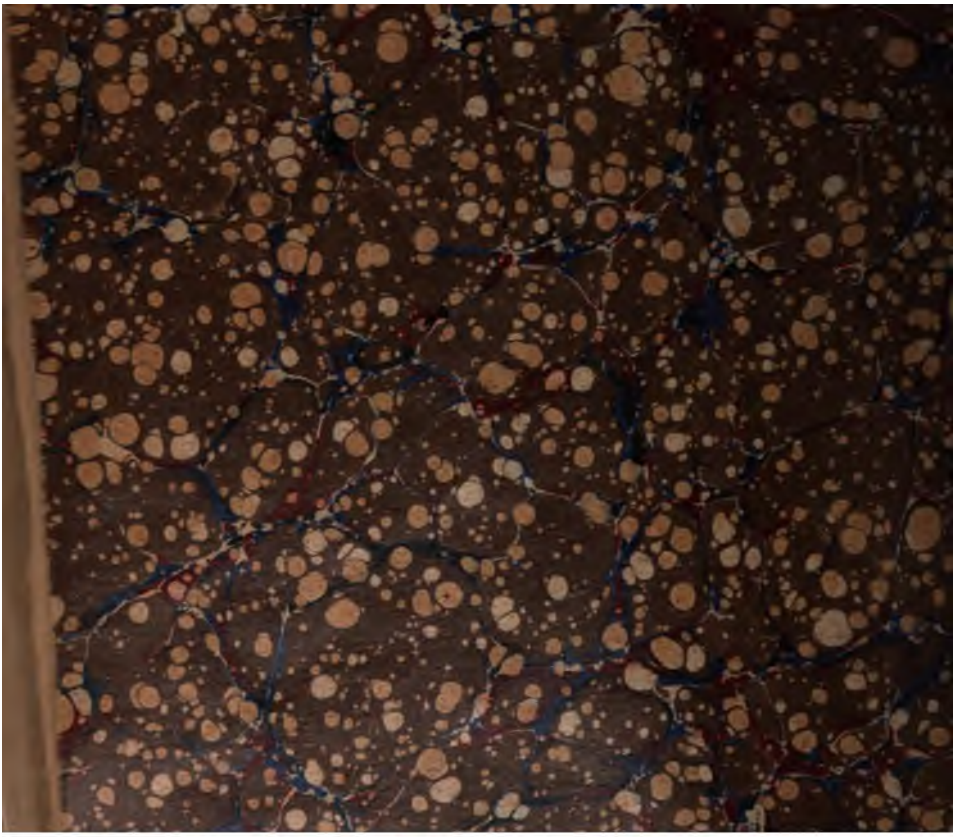
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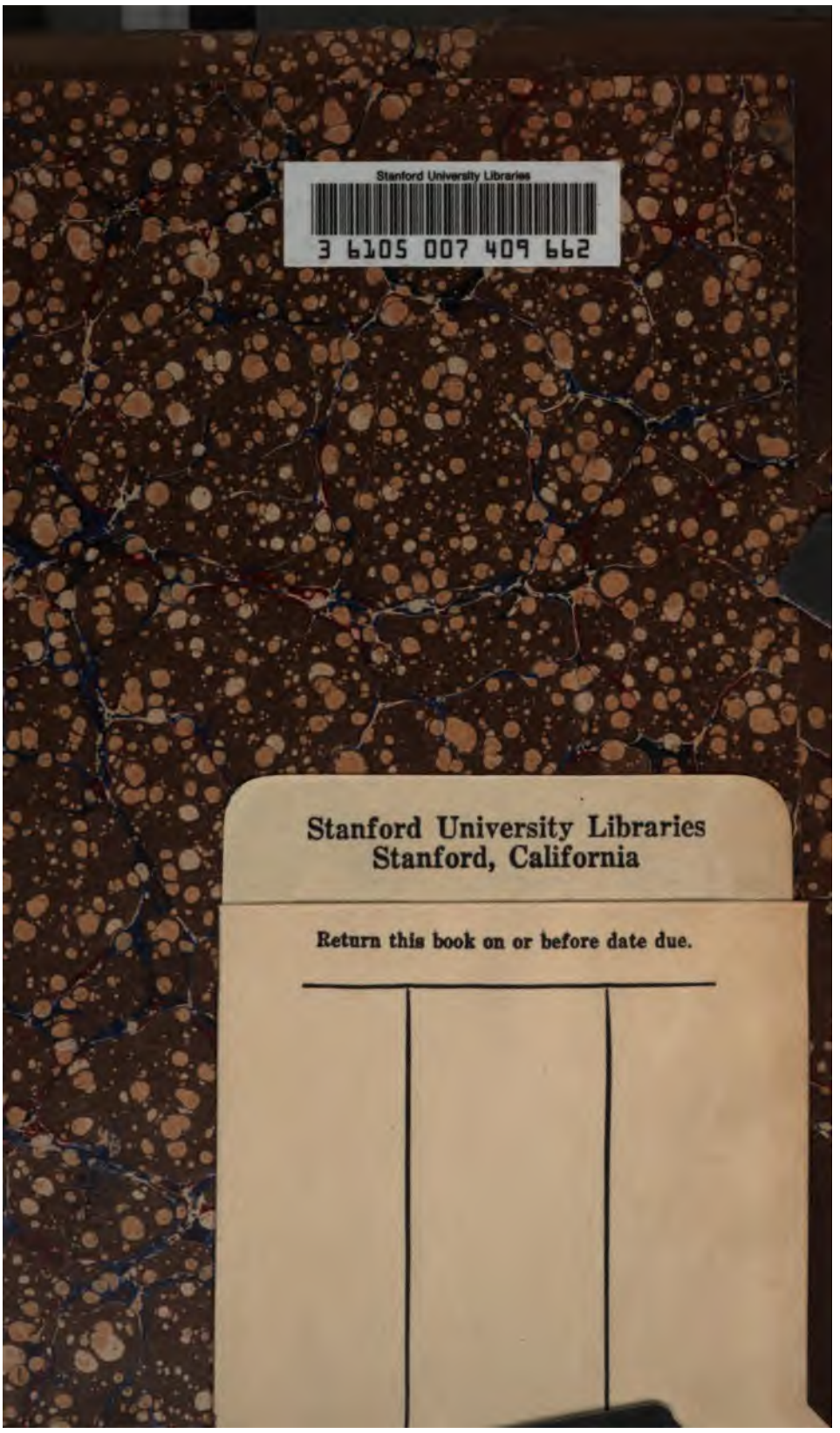
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